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Volume LXV October-December 1997

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ALTERNARIA THEMES AND VARIATIONS (151—223)

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ABSTRACT

A continuation of a series of papers primarily on *Alternaria*, in this instance for phaeodictyosporic species described from hosts/substrates in the Asteraceae (Compositae). Of the approximately 75 names published in legitimate or illegitimate names for this group (1838 to date), 34 are retained or newly proposed here for recognizable taxa in *Alternaria, Embellisia, Nimbya* and *Stemphylium*; 12 names are presented as spp. nov. or comb. nov., including *Alternaria agerati* Sawada ex Simmons, *A. argyranthemi* Simmons & C. F. Hill, *A. argyroxiphii* Simmons & Aragaki, *A. blumeae* Simmons & Sontirat, *A. cirsinoxia* Simmons & Mortensen, *A. danida* Simmons, *A. franseriae* Simmons, *A. nattrassii* Simmons, *A. petalicolor* (Sorokin) Simmons, *Nimbya rhapontici* (Nelen) Simmons, *Stemphylium cirsii* (Lindau) Simmons and *S. kriegerianum* (Bresadola) Simmons.

XXIV. SPECIES OF ALTERNARIA ON ASTERACEAE with disposition of names of non-*Alternaria* phaeodictyosporic hyphomycetous species described from the same host family

About 75 names with *Alternaria* potential have been published (1838 through these present notes) for species of phaeodictyosporic hyphomycetes observed on or isolated from species of Asteraceae. All are discussed, including some that are treated here in limbo because they lack not only typifying specimens or illustrations but also any tradition of usage in mycosystematics. A few names have been added in order to present novel species and taxonomic opinions, updating our knowledge of *Alternaria* and other phaeodictyosporic genera associated with members of the enormous host family Asteraceae. As was done in all previous papers of the *Alt.T&V* series, an attempt is made here to determine the application of all pertinent names published in the genus *Macrosporium* Fr.

A few of these names represent intimate mixtures of taxonomically unrelated moulds on senescent or dead material. A few other names represent essentially pure stands of identifiable small-spored species, usually but not always on senescent plant parts. Most of the relatively small-spored taxa can be synonymized with earlier names in the *A. alternata*, *A. tenuissima*, and *A. infectoria* groups. Others can be equated with names in genera other than *Alternaria*.

The majority of names, however, have been published for *Alternaria* species that can be segregated into conidium-morphology groups with comparatively large conidia, with erostrate conidia, or with filament-beaked conidia. Most species of these latter groups have histories in phytopathology. When isolates of these are at hand, they are used to expand and standardize descriptive treatments presented below. Routine culture conditions (Simmons and Roberts, 1993) include 100mm diam. Y-plates with PCA, hay decoction, and V-8 juice agars; room temperature near 20C; 8/16hr. cool-white fluorescent light/dark cycle.

It is my intention to consider here all names already published for these asteracicolous species and to give an opinion on the classification and correct name of each, with particular attention to interpretation of their type specimens. Descriptions of novel taxa are inserted near treatments of similar, already published species.

It seems superfluous to state an opinion that this discussion of 27 species retained in *Alternaria* does not even come close to being a comprehensive compendium of *Alternaria* species on members of the Asteraceae. If *Helianthus annuus* alone harbors at least three well-defined species of *Alternaria* (*Alt.T&V* 17-21; Simmons 1986a), it seems likely that a few dozen or scores more may exist as undiscovered tenants of the approximately 13,000 species of Asteraceae.

Among field specimens available to me are several that are readily distinguishable among themselves on the basis of field sporulation but for which there are no isolates (e.g., four from *Lactuca*). I have refrained from including most of such entities here, principally because *Alternaria* conidia from the field are not always readily identifiable developmentally and morphologically with conidia in derivative cultures. Pitfalls for misjudgments are numerous; so only a few new species have been described here on the sole basis of dried field material, and these only when they are strikingly different from any other known species.

* * * * *

A digression into the matter of typification of names, the type specimens of which are, on the basis of available information, known to be or presumed to be lost.

The circumstance of lost or unlocatable type specimens is fairly common among the hundreds of *Macrosporium* and *Alternaria* names, even after years of diligent searching and voluminous correspondence. Given the fact that a single host species may harbor several different large-spored *Alternaria* species (e.g., three to date on sunflower; four to date on poinsettia), it is taxonomically hazardous to attempt neotypification of an orphaned *Alternaria* name except with great care and detailed knowledge of the species involved. I have made no neotypifications in this paper and very rarely have done so elsewhere.

In the absence of original specimens related to a legitimate name, articles of the most recent edition of the International Code of Botanical Nomenclature (Greuter et al., 1994) permit use of an illustration as nomenclatural type. Such a choice is a lectotype. I have made such a choice for several names treated herein when it was practically certain that original specimens are lost. In each instance the reference is: (ICBN Art. 8.3, 9.9; Greuter et al., 1994).

* * * * *

The taxa are organized and presented in groups, based on similarity of conidium characters. Species-group designations (e.g., "*A. infectoria* group") are based either on concepts developed in earlier *Alt.T&V* papers or are introduced here, using old, well-established names. One such group concept is adopted from Elliott (1917), namely, that of the *A. sonchi* group.

***Alt.T&V* 151-180**: species with relatively small to medium-sized conidia that are retained in the genus, mostly chain-formers with resemblance to the *A. alternata*, *A. tenuissima*, and *A. infectoria* groups. These are discussed in chronologic order of publication. Also included here are phaeodictyosporic entities on Asteraceae that I have examined for *Alternaria* potential but that require generic placement elsewhere, e.g., in *Stemphylium*, *Embellisia*, etc.

Alt.T&V 181-182: a single *Nimbya* species.

Alt.T&V 183-191: the *Alternaria sonchi* group, with erostrate conidia of medium size, which may remain solitary or may become catenulate by means of apical secondary conidiophores.

Alt.T&V 192-193: the *Alternaria helianthi* group; conidia large, long-cylindrical, long-ellipsoid or long-ovoid, erostrate, usually solitary (rarely short catenate).

Alt.T&V 194-223: species whose conidia have filiform beaks; treated in order of increasing size of the spore body.

* * * * *

Alt.T&V 151-180 Small-spored Alternaria and miscellaneous extra-Alternaria species

151. **Mystrosporium stemphylium** Corda (1838), Icones Fungorum II, p. 13. Tab. X, fig. 61.

Lectotype: Corda's cited illustration (ICBN Art. 8.3, 9.9; Greuter et al., 1994). A typifying specimen "*auf Stengeln und Blättern der Georginen* [= *Dahlia* sp.] *und Malven* [= *Malva* sp.]" has not been found among Corda's specimens at [PR].

Corda's description and illustration of small, pleomorphic, thick-walled dictyospores borne singly on erect conidiophores could represent a *Ulocladium*, an *Alternaria*, or some other genus, or an indecipherable mixture of them. Corda remarked in this context that since *Alternaria tenuis* and *rudis* live parasitically on other hyphomycetes [!], there is a possibility of admixture of their conidia with similar ones of his *M. stemphylium* -- and that one must be on one's guard ("*Man muss sich hüten*"); and so we must be with this "species" and with the few references to it in the literature (cfr. Wakefield and Bisby, 1941). A convincing opinion on the taxon is impossible unless authentic material is found.

152. **Stemphylium cordae** Fries (1849), Summa Veget. Scand., p. 506.

Lectotype: Corda's illustration of *Mystrosporium stemphylium*, Icon. Fung. II, p. 13; Tab. X, fig. 61. 1838 (ICBN Art. 8.3, 9.9; Greuter et al., 1994).

Fries (in loc. cit.) transferred three Corda names from *Mystrosporium* and *Helminthosporium* to *Stemphylium* Wallroth. His *S. cordae* Fr. is simply an illegitimate substitute name for "*Mystrosp. Cord. I.f.61* [in error for *II.f.61*]," i. e., for *M. stemphylium* Corda (see *Alt.T&V* 151 above). Fries mentioned no specimens; his substitute name and the original one of Corda are impossible to interpret or apply today.

153. **Macrosporium caudatum** Cooke & Ellis (1878a), Grevillea 6: 87. Pl. 99, fig. 14.

Lectotype [**NY**]: *On stems of Phytolacca. . . No. 2751*; (EGS 05-002).

The name was based on Ellis collections 2751 and 2752 on stems of *Phytolacca* and of *Lactuca* respectively. Although *Alternaria* conidia partially consistent with the type description are present on the *Lactuca* material (EGS 05-005), they are intermixed to a discouraging degree with other moulds and toruloid hyphal elements of indeterminable affinity. A distinctive *Alternaria* more nearly matching the type description and illustration is fairly abundant on the *Phytolacca* specimen, hence its choice as lectotype.

The *Alternaria* present in the lectotype has conidia in the small/medium size range for the genus, reaching about 40-60μm in length. As Neergaard (1945) suggests, it resembles *A. tenuissima* (Fries) Wiltshire more than it does typical "*A. tenuis*" (i. e., *A. alternata* (Fr.) Keissler). *Macrosporium caudatum* is one of several distinctive, commonly encountered saprophytic species belonging to the *Alternaria tenuissima* group, but which cannot now be identified more precisely without cultures. See *Alt.T&V* 116-122 discussion of the *A. tenuissima* group (Simmons 1995).

154. **Sporidesmium irregularis** Cooke (1878), ex Ravenel and Cooke, Fungi Amer. Exs. 158 [nom. nud.]; then in Cooke (1878), Grevillea 6: 136.

Lectotype [**PH**]: *In caulibus Eupatorii. Aiken, S. Car.*; (EGS 03-137).

The effuse, dark fungal growth is a mixture dominated by *Cladosporium*, but it also contains sporulation elements that are variously septate, lobed, clavate, brown, dark-walled, as Cooke described them. They are associated with linear surface hyphae with cells of a similar character. These irregular, thick-walled elements are reminiscent of those illustrated for species of *Trimmatostroma* Corda (cfr. M. B. Ellis, 1971a). Other than this observation, I have no opinion on the correct disposition of the name.

155. **Macrosporium atrichum** Cooke & Ellis (1878b), Grevillea 7: 39.

Lectotype [NY]: *On Lactuca sp., New Jersey, coll. & det. J. B. Ellis Ex-type #3015*, ex USDA-BPI-Path. & Myc.Coll. 61200; (EGS 02-195).

The specimen bears a mixture of a small-spored *Alternaria*, an *Epicoccum*, a *Pithomyces*, and other moulds. The type description of a thin, effuse growth of sessile, ovate to elliptical, 2-3 transversely then muriformly septate, 20-30 x 10-15μm conidia best fits the *Pithomyces*, which is *P. chartarum* (Berk. & Curt.) M. B. Ellis.

156. **Macrosporium inquinans** Cooke & Ellis (1878b), Grevillea 7: 39.

Lectotype [NY]: *On Lactuca [stem], Newfield, N. J., June 1878. no. 3032.*; (EGS 05-125).

This collection holds an abundant, velvety, inquinate (staining, befouling) growth of one of the most commonly encountered of all species-groups of *Alternaria*. The obclavate, sometimes apically attenuate dictyospores reach moderate sizes in the 40-50 x 15-20μm range and often are definitely constricted at the median transverse septum. *Macrosporium inquinans* is a member of the *A. tenuissima* group, perhaps even typical of the basic species. See *Alt.T&V* 116-122 (Simmons 1995) for discussion of the *A. tenuissima* species-group.

157. **Sporidesmium fumago** Cooke (1881), ex Ravenel and Cooke, Fungi Amer. Exs. 563, 564 [nom. nud.]; and in Cooke (1883), Grevillea 12: 28.

I refrain from choosing a type for this species, as the miscellaneous pertinent material I have seen is not at all alternarioid. Cooke spoke of dark, small (20 x 15μm) spores that were subellipsoid, cellular, and in chains of 3-4 units. He listed in the type description four numbered Ravenel collections on *Crataegus*, pear, *Helianthus*, and *Euonymus*. The fungus material on euonymus and pear leaves (EGS 03-136A & B) is fumagineous, sometimes intermixed with *Cladosporium*, and resembles sporulation elements illustrated for *Trimmatostroma* Corda (M. B. Ellis, 1971a). I have not seen the material cited on *Crataegus* or on *Helianthus*, the latter asteraceous host having suggested inclusion here of notes on this early name of a phaeodictyosporic species.

158. **Macrosporium erumpens** Cooke (1882), ex Ravenel and Cooke, Fungi Amer. Exs. 605 [nom. nud.]; and in Cooke (1883), Grevillea 12: 32.

Lectotype [**NY**]: *On Dahlia [stem], Aiken, S. C., HWR[avenel] 2992.*; (EGS 05-090).

An *Alternaria* is present, sporulating in discrete erumpent fascicles on black lesions of an aging or dead stem. Short, ovoid dictyospores as long as 50μm (including a short apical pseudorostrum) are found on the specimen, though not in abundance. Cooke gave dimensions of 70 x 17μm.

The scanty material of this specimen cannot be distinguished from, and is considered to be *Alternaria alternata* (Fr.) Keissler. Joly (1964) made a combination *Alternaria erumpens* (Cooke) Joly for this small-spored, probably saprophytic taxon. See *Alt.T&V* 174 below.

159. **Alternaria hispidula** Ellis (1883), Bull. Torrey Bot. Club 10: 52.

Holotype [**NY**]: *On sagebrush, Utah Ter., S. J. Harkness. Spring 1881.*; (EGS 02-078).

The fungus is somewhat sporodochial, comprising Ellis's "branching, minutely roughened threads, expanding at intervals of 15-20μm into oval-elliptical, 3-4 septate, minutely roughened spores, 12-20 x 8-12μm." It appears to be a species of *Coniosporium* Link or of *Trimmatostroma* Corda on a twig of sagebrush, *Artemisia* sp. (not herbal sage, "*Salvia*?," as queried by Saccardo (1886) and as compiled by Joly (1964)). There is nothing alternarioid about this fungus.

160. **Polydesmus petalicolor** Sorokin (1888), Centralbl. Bakteriol. Parasitenk. 4(21): 647; fig. 19-34. Fig. 128

Lectotype [**NY**]: *C. Roumeguère, Fungi selecti exsiccati 5095; Cultures [aster species] du Jardin Botanique de Kazan (Russie) septembre 1888. N. Sorokine.*; (EGS 16-099).

The type fungus is an *Alternaria* that occurs inconspicuously on an asteraceous inflorescence, presumably one of the cultivars cited in the type description. Sorokin went into remarkable detail, for his period, on the origin of conidia as well as their growth, septation, chain formation and germination. His illustrations are mostly of solitary, ovate conidia that reach a maximum length of about 50μm. This compares well with conidia examined more recently from the type, which are of the small/medium-size spore group of species.

Polydesmus petalicolor is a distinctive species of *Alternaria*, for which a new name combination is made for the reasons given below: **Alternaria petalicolor** (Sorokin) E. Simmons, comb. nov.; basionym *Polydesmus petalicolor* Sorokin (Centralbl. Bakteriol. Parasitenk. 4: 647. 1888.); lectotype [**NY**] of the name as selected and cited above.

Most *Alternaria* field specimens characterized as having "solitary, ovate conidia that reach a maximum length of about 50μm" and have some evidence of chain formation would merit little attention further than assignment, perhaps, to an "*A. alternata* group" of species. However, a fungus identifiable as *Alternaria petalicolor* has been described twice from field collections of Asteraceae in widely separated geographic locations, namely, Kazan, Tatar A.S.S.R. (by Sorokin), and Ontario, Canada (by J. B. Ellis and J. Dearness in 1893; see *Alt.T&V* 164 below).

Conidia of *A. petalicolor* are predominantly short ovoid with a broadly rounded base and an upper half that tapers gradually into a blunt or short-conical apical region without a definable true beak. Sorokin illustrated conidia in fresh collections as being solitary or as 2-3 borne in a tight clump at the tip of a closely geniculate conidiophore. He also illustrated and mentioned a short chain of 3 conidia; the presence in the type specimen of a small number of conidia with apical secondary conidiophores supports this observation of a catenate character.

The predominant erostrate dictyic conidia and conidium bodies with at least one longitudinal septum are 33-42(-50) x 15-18μm and have 3-5(-7) transepta and 1-2 longisepta in each of the basal and central transverse divisions. The straw-colored outer wall of conidia is completely and often obscuringly punctulate. Apical secondary conidiophores may be only a short single cell or as large as 30 x 3μm. Key characters of *A. petalicolor* are the relatively small, blunt/conical-tapered, pale, obscuringly ornamented conidia.

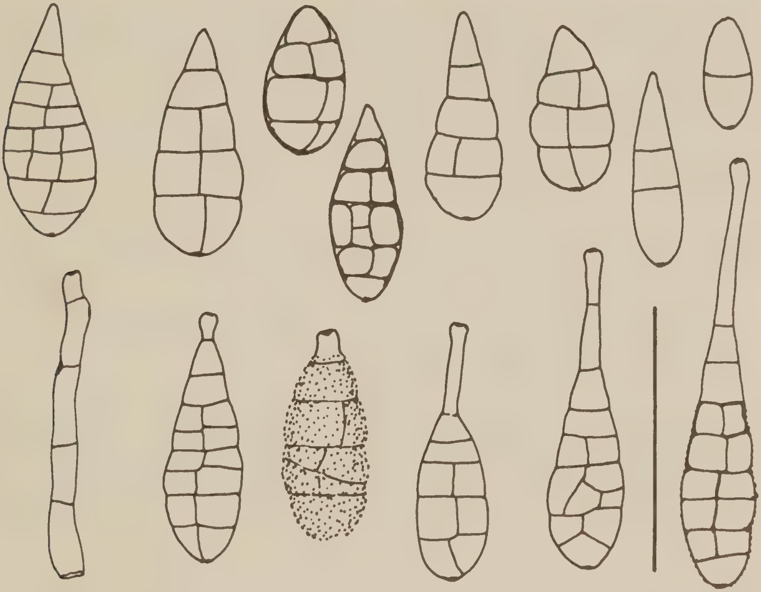

Fig. 128. *Alternaria petalicolor*: conidia and conidiophores ex lectotype specimen (EGS 16-099). Bar = 50μm.

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161. **Sporidesmium macrosporioides** Ellis & Galloway (1889), Journ. Mycology 5: 67; not *Epochnium macrosporoideum* Berkeley (1838), which is a *Monodictys*.

Holotype [**NY**]: *Anderson: Parasitic Fungi of Montana; Macrosporium puccinioides* [sic] *Ell. & Anders.; 391...Artemisia tridentata?...Glendale...Oct/88...on dead stems; Coll. F. W. Anderson*; (EGS 05-195).

The fungus name on the type packet is on a separate label in Ellis's handwriting and is pasted over the original name on the packet (now indecipherable). Anderson's coll. 391 is the specified type in publication. Its identity needs to be searched for in *Stigmina* Saccardo or in a similar genus. It is not an *Alternaria*.

162. **Stemphylium insidens** Cooke & Massee, ex Cooke (1890), Grevillea 19: 49.

Holotype [**K**]: *On leaves of Pleurophyllum speciosum; Campbell Island* [New Zealand; not "*Americae bor.*" (Saccardo, 1892)], *Kirk 341.*; (EGS 10-150).

The fungus occurs as dense masses of dark dictyospores concentrated among the cottony host hairs rather than on the leaf surface itself. The published type dimensions of 18-20 x 8μm for conidia are misleading, for many conidia of the type are in the 27 x 15μm range. The fungus is an excellent representative of *Ulocladium* Preuss, specifically *U. botrytis* Preuss.

163. **Macrosporium puccinioides** Ellis & Anderson (1891), Bot. Gaz. 16: 47. Pl. VII, figs. 7-11.

Holotype [**NY**]: *On Bigelovia? Helena, Montana; Nov. 1, 1888. Kelsey 88/141*; (EGS 05-191).

Sporodochial tufts of spores are similar to those of the type of *Sporidesmium macrosporioides* Ellis & Galloway (*Alt.T&V* 161 above). It is interesting to note that Ellis relabeled his type specimen of *S. macrosporioides* to read *M. puccinioides*. The two names may well represent the same dictyosporic fungus, possibly a species of *Stigmina* Sacc.

164. **Macrosporium florigenum** Ellis & Dearness (1893), Canad. Rec. Sci. 5: 271.

Lectotype [**DAOM**]: *22nd Sept. 1891* [Dearness no.] *1459*, [on petals and bracts of an asteraceous inflorescence, with an enclosed note] "*The Macrosporium on petals of Aster is so peculiar that it perhaps deserves a name -- Call it M. florigenum, E. & D.*" [and with a Dearness ms. notation] "*JBE 29 Augt 1892.*"; (EGS 09-074).

A lectotype is chosen here for *M. florigenum* because portions of the original field collection are found not only at **DAOM** but also in the "Ellis Collection" (**NY**; EGS 03-050) and in numerous packets distributed as exsiccati in *Ellis & Everhart, North American Fungi, Second Series, 3097*.

The lectotype bears growths of two small-spored species of *Alternaria* having maximum conidium dimensions near 40-50 x 17-18μm. The type description (and the lectotype) specifies conidia 15-40 x 12-18μm that are 3-5-septate with one or occasionally two longitudinal septa. Such conidia are abundant; they characteristically have a bluntly tapered or broadly wedge-shaped apex and punctulate ornamentation over the entire conidium body. (The second *Alternaria* species on this specimen has ellipsoid conidia with as many as seven dark, transverse or oblique septa plus 1-2 longitudinal septa in all but terminal cells. The densely cellular, dark-walled appearance of this second taxon gives a very different picture than the paler, less septate, ovoid conidia of *M. florigenum* and need not be confused with it.)

The fungus of the lectotype of *M. florigenum* is *Alternaria petalicolor* (*Alt.T&V* 160 above).

For the record, Nelen published a name combination *Alternaria florigena* (Ell. & Dearn.) Nelen, ex Nelen and Vasiljeva (1959), using as study material some collections on *Callistephus chinensis* and *Aster alpinus* from the Far Eastern Region (Primorski Krai), U.S.S.R. I believe that he was not handling the same fungus as that of the Sorokin and the Dearness collections as he gave conidium dimensions of 42-82 x 11-16μm, which suggests narrow conidia becoming nearly twice as long as those in the Sorokin and Dearness specimens. In any case the Nelen new combination lacked full and direct reference to basionym data, citing instead a secondary compilation ("Sacc., Syll. Fung., XI, p. 636"), and thus was not published validly (ICBN Art. 33.2, 33.4; Greuter et al., 1994).

Joly (1964) repeated the data of the 1893 *M. florigenum* type description under the name "*A. florigena* (E. & D.) Nelen et Vasileva," to which he appended a full and direct reference to the place of valid publication of the basionym. This might be considered establishment of the legitimacy of the name combination, even though Joly expressed no such intent in his writing. The name, if treated as legitimate, is a taxonomic synonym of *A. petalicolor* (Sorokin) Simmons.

165. **Stemphylium laxum** Ellis & Everhart (1895), Proc. Acad. Nat. Sci. Philadelphia 47: 440.

Holotype [**NY**]: *Dead stems of Bigelovia graveolens Gray/Grand Junction, Colorado/May 26, 1894. (Prof. C. S. Crandall) No. 110*; (EGS 06-057).

Conidia of this fungus tend to enlarge through a subapical, unilateral, almost circinate production of septa and cells, essentially as in *Monodictys* Hughes. Certainly it is not a species of *Stemphylium* Wallroth or of *Alternaria*.

166. **Macrosporium kriegerianum** Bresadola (1897), Hedwigia 36: 382. Fig. 129E

Holotype [**BKL**]: *Auf Mulgedium alpinum am Arber im Böhmer-Wald. 27.Juli 1896. leg. W. Krieger*; (EGS 03-199).

The distinctive fungus present in abundance on host leaves is a typical species of *Stemphylium* Wallr., with conidia larger and more cellular than those of *S. botryosum* Wallr., and thus is a member of a complex of species similar to *Stemphylium herbarum* Simmons, the anamorph of *Pleospora herbarum* (Fr.) Rabenhorst.

Stemphylium kriegerianum (Bresadola) E. Simmons, comb. nov.; basionym *Macrosporium kriegerianum* Bresadola (Hedwigia 36: 382. 1897. Holotype [**BKL**], as cited above). Conidiophores are abundant and crowded on the host, often are only 2-celled and ca. 20μm long but also may be up to ca. 70-80μm and always expanding from ca. 5μm at the base to a strikingly flared conidiogenous apex ca. 12μm diam. Conidia are broadly ovoid or obovoid, up to ca. 45-50 x 30-32μm, maturing with 4-5 transverse or oblique septa and 2-3 series of longisepta. The pattern of septation seldom appears strictly rectangular because of the oblique orientation commonly exhibited by some of the transepta. Conidia are punctulate overall, olivaceous tan, and have a conspicuous basal hilum.

167. **Macrosporium arnicae** Rostrup (1905), Bot. Tidsskr. 26: 315.

Holotype [**C**]: *In foliis vivis Arnicae montanae. Fyn: Nyborg. 15th June 1901*; (EGS 11-053).

The fungus present is a typical species of *Stemphylium* Wallr. with conidia larger and more cellular than those of *S. botryosum* Wallr. Thus it is a member of a complex of species similar to the *S. herbarum* anamorph of *Pleospora herbarum*. The type specimen has too few conidia to permit an opinion on the uniqueness or identity of the taxon other than its placement in *Stemphylium*.

168. **Macrosporium cirsii** Lindau (1908), in Rabenhorst's Krypt. Fl., Erster Bd., Pilze 9: 250. Fig. 129B

Holotype [**B**]: *Flora Danica. . .Circium [sic] arvense. Jütland, Wiborg 28-8-1904. J. Lind.*; (EGS 10-086).

The fungus described by Lindau is a typical *Stemphylium*

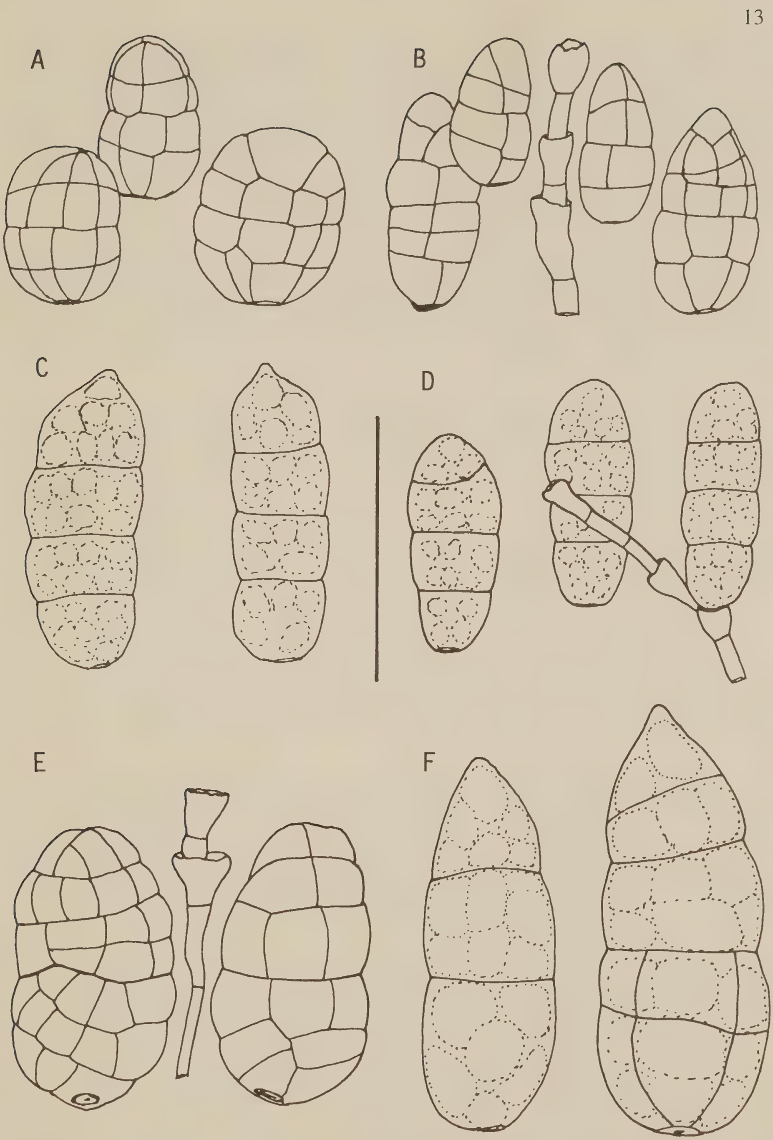

Fig. 129. *Stemphylium*: comparison of representative conidia of A. *S. globosum*; B. *S. cirsii*; C. *S. lycopersici*; D. *S. nabarii*; E. *S. kriegerianum*; F. *S. callistephi*. Conidium walls of *S. callistephi* are smooth; those of the other species are punctulate overall. Bar = 50μm.

but not of the *S. botryosum* group. Instead, its conidia (up to about 40 x 20µm) often are somewhat inequilateral, usually have only one directly transverse septum (the median one) with others only partial or variously oblique, sometimes have an obtusely eccentric apical cell, are rough-walled overall, and are associated with extremely long percurrently proliferating conidiophores (ca. 200µm long).

The species is one of several having this general appearance of slightly inequilateral conidia with a somewhat eccentric apex. I believe that this species is the earliest one in the literature that has conidia incorporating all the characteristics noted.

Stemphylium cirsii (Lindau) E. Simmons, comb. nov.; basionym *Macrosporium cirsii* Lindau (in Rabenhorst's Krypt. Fl., Erster Bd., Pilze 9: 250. 1908). Holotype [B], as cited above.

169. **Thyrospora chisha** Nishikado & Hiura (1950), Nōgaku Kenkyū 39(1): 40.

Lectotype: an unnumbered figure of conidia and conidiophores (loc. cit.). A specimen on *Lactuca scariola* L., coll. 29 July 1947, was cited in the type description. I have not been able to locate or verify the existence of this collection.

The name was published without a Latin description or diagnosis, therefore invalidly (ICBN 36.1; Greuter et al., 1994). The illustration and description in Japanese are of a typical *Stemphylium.* An attempt to bring a legitimate name for the taxon into the literature was made by W. Yamamoto (1960). See *Alt.T&V* 170 below.

170. **Stemphylium chisha** (Nisikado & Hiura) Nisikado ex Yamamoto (1960), Trans. Mycol. Soc. Japan 2(5): 93 [as "(Nisikado & Hiura) Nisikado, comb. nov. Syn. *Thyrospora chisha* Nisikado & Hiura, Nōgaku Kenkyū 39: 40 (1950), nom. seminud."]

Lectotype: an unnumbered figure of conidia and conidiophores of *Thyrospora chisha* in Nis[h]ikado and Hiura (1950, p. 40). See *Alt.T&V* 169 above.

Yamamoto (1960) provided a Latin description for the taxon, intending to validate the non-latinized "nom. seminud." introduced by Nisikado and Hiura (1950; see *Alt.T&V*

169 above). Since the name "*Thyrospora chisha*" never was validly published and the validating description of "*Stemphylium chisha*" is Yamamoto's, the correct name is *S. chisha* Nisikado ex Yamamoto, or simply *S. chisha* Yamamoto (ICBN Art. 46; Greuter et al., 1994).

The distinguishing conidia of *Stemphylium chisha* were said to be ovoid to ellipsoid with a more or less papillate apex, and they were drawn in this form in the original 1950 illustration. They have a primary transmedian, somewhat constricting septum and may become up to 7-transeptate with 0-2 longisepta in each transverse segment. Conidia are punctate, pale gray-brown, 25-79 x 5-39μm.

I have not found this fungus on any collection of *Lactuca* sp., although *S. lycopersici* Enjoji ex Yamamoto (1960) and a member of the *S. herbarum* group (in the literature under the illegitimate name *S. botryosum* f. *lactucum* (Padhi and Snyder, 1954) have been seen. The somewhat apiculate character of *S. chisha* conidia is not unique to the species. Similar mammiform, sometimes slightly eccentric apices occur, for example, in *S. callistephi* Baker & Davis (*Alt.T&V* 171 below) and in *S. solani* Weber (1930).

171. **Stemphylium callistephi** Baker & Davis (1950b), Mycologia 42: 482. Fig. 129F

Lectotype [**BPI** ......]: *on living leaves, bracts and flowers of Callistephus chinensis Nees* [only leaves in lectotype packet]; *Coll.: Redondo Beach, California, U.S.A. August 16, 1946.. . .Type material*; (EGS 07-008).

The authors of *S. callistephi* indicated (l.c., p. 482) that specimens of the taxon were deposited in seven different herbaria. A portion examined at BPI matches essential type data and is selected as lectotype of the name. The original publication is thorough, both mycologically and phytopathologically, and is well illustrated.

Briefly, conidiophores and conidia of the species are relatively large for the genus. Conidiophores on the host commonly are as large as 110 x 10μm, with four or more successively percurrent conidiogenous sites ca. 15μm diam. Fully developed conidia are ca. 70 x 32μm and long ovoid with a broadly rounded, almost flat base and a distinctive nipple-shaped apex. Usually two constricting transverse eusepta are evident; an additional 4-5 transverse partitions appear distoseptate and are optically poorly defined, as are most of the longitudinal interfaces of internal cells. Mature conidium size may be compared with that of some well-known species of *Stemphylium*: *S. callistephi*, 70 x 32μm; *S. botryosum*, 45 x 30μm; *S. vesicarium* 45 x 22μm (Simmons, 1990b, pp. 17-20).

172. **Alternaria florigena** (Ell. & Dearn.) Nelen, ex Nelen and Vasiljeva (1959), Bull. Centr. Bot. Gard., Moscow, 35: 83.

Lectotype [**DAOM**]: *22nd Sept. 1891* [Dearness no.] *1459*, [on petals and bracts of an asteraceous inflorescence, with an enclosed note] "*The Macrosporium on petals of Aster is so peculiar that it perhaps deserves a name -- Call it M. florigenum, E. & D.*" [and with a Dearness ms. notation] "*JBE 29 Augt 1892.*"; (EGS 09-074).

The Nelen new combination (1959) lacked essential basionym data and thus was not published validly (ICBN Art. 33.2; Greuter et al., 1994). See *Alt.T&V* 164 above, *Macrosporium florigenum*, for discussion.

173. **Alternaria florigena** (Ell. & Dearn.) Nelen & Vasiljeva ex Joly (1964), Encycl. Mycol. 33: 201.

Lectotype [**DAOM**]: *22nd Sept. 1891* [Dearness no.] *1459*; (EGS 09-074).

Joly's entire nomenclatural and bibliographic entry reads: "*Alternaria florigena* (E. et D.) Nelen et Vasiljeva (Bull. Centr. Bot. Gdn, Moscou, XXXV, p. 82, 1959; Synonymie: *Macrosporium florigenum* Ellis et Dearness (Canad. Res. Sci., p. 272, 1893)". There is no accompanying indication that Joly intended to create this new combination or to validate one published earlier, but invalidly, by Nelen ex Nelen & Vasiljeva (1959); see *Alt.T&V* 172 above. Nevertheless, inadvertently or not, this is the first place where an *Alternaria* name based on *Macrosporium florigenum* Ell & Dearn. complies with ICBN rules governing valid publication of a new combination, through giving a full and direct reference to the place of publication of the basionym (ICBN Art. 33.2; Greuter et al., 1994).

Alternaria florigena in any format is a taxonomic synonym of *A. petalicolor* (Sorokin) Simmons. See *Alt.T&V* 160 above for *Polydesmus petalicolor* Sorokin (1888) and *Alt.T&V* 164 for *Macrosporium florigenum* Ell. & Dearn. for discussion.

174. **Alternaria erumpens** (Cooke) Joly (1964), Encycl. Mycol. 33: 199.

≡ *Macrosporium erumpens* Cooke, Grevillea 12: 32. 1883. Lectotype [**NY**]: *On Dahlia [stem], Aiken, S. C., HWR[avenel] 2992.*; (EGS 05-090).

The scanty material of this specimen cannot be distinguished from, and is considered to be *Alternaria alternata* (Fr.) Keissler. See *Alt.T&V* 158 above.

When Joly (1964) published the combination *Alternaria erumpens* for this small-spored species, he made a concurrent suggestion that *Alternaria carolinaeana* Unamuno (1941) is synonymous with *A. erumpens*. However, the Unamuno holotype on *Dahlia* leafspots [**MA**] (EGS 12-099) is of one of the large-spored, rostrate species of *Alternaria*. The Unamuno specimen is scanty and the conidia on the lesions are in poor condition, so that we may never be able to identify *A. carolinaeana* positively. Nevertheless, the appearance of the conidia and Unamuno's illustration and conidium measurements (43-150 x 10.7-21.5μm) certainly are of a species unlike *A. erumpens* with its ovoid conidia ca. 50μm long in the lectotype ("70 x 17"μm in type description).

175. **Stemphylium nabarii** M. Sarwar, ex M. Sarwar and K. V. Srinath (1966), Mycopath. Mycol. Appl. 29: 321.

Fig. 129D

Lectotype [**IMI** 109481]: Host *Pyrethrum* [leaves of *Chrysanthemum cinerariifolium* (Trevir.) Vis.], *India*, Coll. *M. Sarwar, comm. 30.9.64.*; (EGS 21-116).

The type description and accompanying illustrations present sporulation structures of two different fungi: very long, distinctively percurrent *Stemphylium* conidiophores (up to 315 x 6-8.5μm) and conidia of a species of *Alternaria* (42-50 x 17-20μm). Elements matching those of both taxa are present in the type specimen. Additionally, although not mentioned, the type bears conidia identifiable as those of one member of a group of species similar to *S. lycopersici* Enjoji ex Yamamoto (1960).

ICBN guidance is that a name must remain attached to that part of a heterogeneous type specimen which corresponds most nearly with the original description (ICBN Art. 9.10; Greuter et al., 1994). Neither element (*Alternaria* conidia or *Stemphylium* conidiophores) of the description, if selected as lectotype, would define a species adequately.

Since Sarwar (l.c.) thanked M. B. Ellis "for help in identification of the fungus," it is a reasonable assumption that Ellis associated the *Stemphylium* conidia and conidiophores present on the specimen and reported an opinion on that basis, but that Sarwar missed the connection and focused on *Alternaria* conidia, also present on the specimen but irrelevant to the Ellis opinion.

In any case, the lectotype specimen, with both *Stemphylium* sporulation elements, and the choice of genus, *Stemphylium*, establish the identity of the species and allow its comparison with other species of *Stemphylium*. The fungus is not typical *S. lycopersici* Enjoji but is one of a group of similar species with conidia considerably longer than wide and with very long conidiophores.

176. **Alternaria dennisii** M. B. Ellis (1971b), Mycol. Papers no. 125, p. 27.

Holotype [**IMI** 151744]: Host *Senecio jacobaea*, Loc. *Blue Port, The Ayres, Isle of Man*, Coll. *R. W. G. Dennis*, Date *20-9-1970*, Det. *M. B. Ellis sp. nov.*; (EGS 30-024).

The taxon is a species of *Embellisia*, *E. dennisii* (M. B. Ellis) Simmons, and was discussed as such in a paper on *Embellisia* species and related teleomorphs (Simmons 1990a).

177. **Alternaria helianthicola** G. N. Rao & K. Rajagopalan (1977), Current Science 46: 750.

Holotype [**IMI** 191573]: a dried-down preparation derived from the "type culture," received at IMI as an isolate from *Helianthus annuus, Tirupati, Andhra Pradesh, India, J. Subbayya 12.2.1975*; (EGS 38-120).

The taxon is a rough-spored member of the *Alternaria infectoria* species-group. See *Alt.T&V* 21 (Simmons 1986a) for discussion of the holotype of *A. helianthicola*. See *Alt.T&V* 23 (Simmons 1986b) for definition of *A. infectoria* Simmons. See *Alt.T&V* 106-109 (Simmons 1994) for description and discussion of other species in the *A. infectoria* species-group.

178. **Embellisia novae-zelandiae** E. Simmons & C. F. Hill, in Simmons (1990a), Mycotaxon 38: 252.

Holotype [**BPI** 749413]: portion of a dried-down culture

EGS 39-099 ex isolate C. F. Hill 4252(a), from Leptinella dioica Hook. f., coll. July 1989, Papakura, New Zealand; (EGS 39-099).

This phaeodictyosporic species, from an asteraceous host often grown as a groundcover in New Zealand, was described and illustrated in a treatment of some *Embellisia* species and related pleosporaceous teleomorphs (Simmons 1990a).

179. **Embellisia leptinellae** E. Simmons & C. F. Hill, in Simmons (1990a), Mycotaxon 38: 254.

Holotype [**BPI** 749412]: portion of a dried-down culture *EGS 39-101 ex isolate C. F. Hill 4252(c), from Leptinella dioica Hook. f., coll. July 1989, Papakura, New Zealand*; (EGS 39-101).

This second species of *Embellisia* from *Leptinella* in New Zealand has some resemblance to *E. dennisii* from *Senecio* (*Alt.T&V* 174 above). Both are discussed in Simmons (1990a).

180. **Alternaria franseriae** E. Simmons, sp. nov. Fig. 130

Conidiophora recta vel flexa, simplicia vel geniculate conidiogena, usque ad 15-60 x 3-5µm. Conidia plerumque solitaria, erostrata, anguste ovoidea vel anguste ellipsoidea, apice obtusirotundato, aureobrunneola, laevia, maturitate 30-40(-50) x 8-12µm, 5-8 transverse vel oblique eu- vel distoseptata, ubique 1(-2) longitudine septata. Conidia aliquando brevicatenata, apice conidiophorigeno 1-2-celluloso, 3-10 x 3-4µm. Habitatio typi in foliis Franseria chamissonis Less. [now Ambrosia c. (Less.) E. Greene]. Holotypus: ***BPI*** *444749, seashore, Waldport, Oregon, July 26, 1937, coll. R. Sprague O.S.C.8407*; (EGS 20-061).

Among herbarium specimens of asteracicolous *Alternaria* that have been examined, only one of the miscellaneous small-spored taxa immediately appears to be novel. Conidia of this specimen predominantly are narrow-ovoid and narrow-elliptical with a bluntly rounded apex. Even when the apex extends into a short secondary conidiophore, the initially erostrate nature of the conidium body remains evident.

Alternaria franseriae is morphologically similar to the first few small-spored species discussed in this *Alt.T&V* series, originally grouped as "*erostratae.*" Conidia of *A. franseriae* are not consistently solitary, unlike beakless *A.*

molesta Simmons and *A. mouchaccae* Simmons (1981; *Alt.T&V* 1, 2), but may proliferate into short chains in nature, as does *A. limaciformis* Simmons (1981; *Alt.T&V* 4).

Conidiophores on the host are simple with a single apical conidiogenous site, or geniculately proliferant with a hilum terminating each short extension, ca. 15-60 x 3-5μm, concolorous with conidia. The narrowly ovoid or ellipsoid, erostrate conidia are golden brown, smooth, and at maturity commonly are 30-40(-50) x 8-12μm with 5-8 transverse, sometimes oblique, scarcely constricting eu- and distosepta and 1(-2) longitudinal septa in a few to all of the transverse sections. Apical secondary conidiophores present on many conidia, and indicating chain formation, typically are only 1-2 narrow cells, 3-10 x 3-4μm.

The *Franseria* host specimen bears sporulation of both *A. franseriae* and a typical species of *Stemphylium*. Conidia of the *Stemphylium* are broadly ellipsoid and constricted at major septa, and have punctate-roughened walls. The differences between the two species are easily seen and need not be confusing.

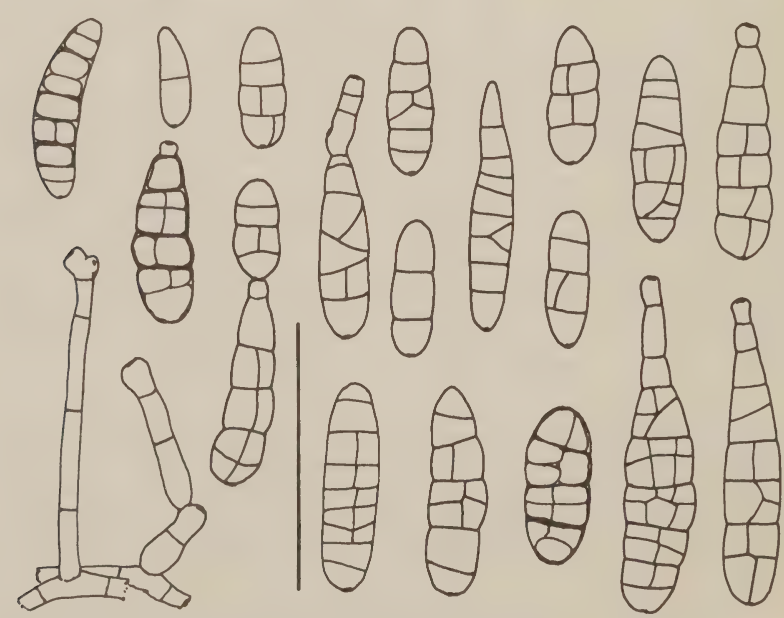

Fig. 130. *Alternaria franseriae*: conidia and conidiophores ex holotype specimen (EGS 20-061). Bar = 50μm.

Alt.T&V 181-182 One Nimbya species

181. **Macrosporium rhapontici** Nelen, ex Nelen and Vasiljeva (1959), Bull. Centr. Bot. Garden, Moscow, 35: 90.

As *M. rhaponticae*: [transl.] *On leaves of Rhaponticum carthamoides, 20.IX 1955, 28.VII and 7.VIII 1957.*

Although amply described in Russian, a Latin description was not provided. Therefore the name was not published validly in 1959 (ICBN Art. 36.1; Greuter et al., 1994).

182. **Macrosporium rhapontici** Nelen (1962), Botan. Mater. 15: 146. Fig. 4. Fig. 131

Holotype [**LE**]: *Macrosporium rhapontici Nelen sp. nova, on Rhaponticum carthamoides*, [translit.]: *Dalnii Vostok, Primorskii krai, okr. Vladivostok, st. Okeanskaya, D. V. Bot. Sad.* [Far East, Primorskii Krai [Maritime Territory], Vladivostok, Okeanskaya Station, Far East Botanical Garden], *Anno **19** 7 VIII **57*** [7 Aug. 1957], *Leg./Det. Nelen, E. S.*; (EGS 20-169).

The name was validly published at this time (1962), with Latin description, illustrations of conidia from the field type, type citation, and type depository.

Conidia of the holotype, as illustrated by Nelen and in the current reexamination, have characters found in several species of *Nimbya* Simmons (1989), notably the long ovoid to ellipsoid, comparatively narrow spore body with a long, almost stiff, narrow beak, and the numerous subangular transverse distosepta through which eusepta are produced tardily.

Nimbya rhapontici (Nelen) Simmons, comb. nov.; basionym *Macrosporium rhapontici* Nelen (Botan. Mater. 15: 146. 1962.); holotype [**LE**] as cited above.

Nelen described conidia from leaf lesions as 70-118μm long with 8-12 transepta, 2-3 longisepta, and a long filiform apical extension; inclusive dimensions for spore body plus beak were given as 122-168 x 12-22μm. My measurements from the holotype are 50-72 x 15μm for the smooth spore body, plus 160-185μm for the solitary beak, which very rarely is 1-branched (only 2 seen in slide preparation).

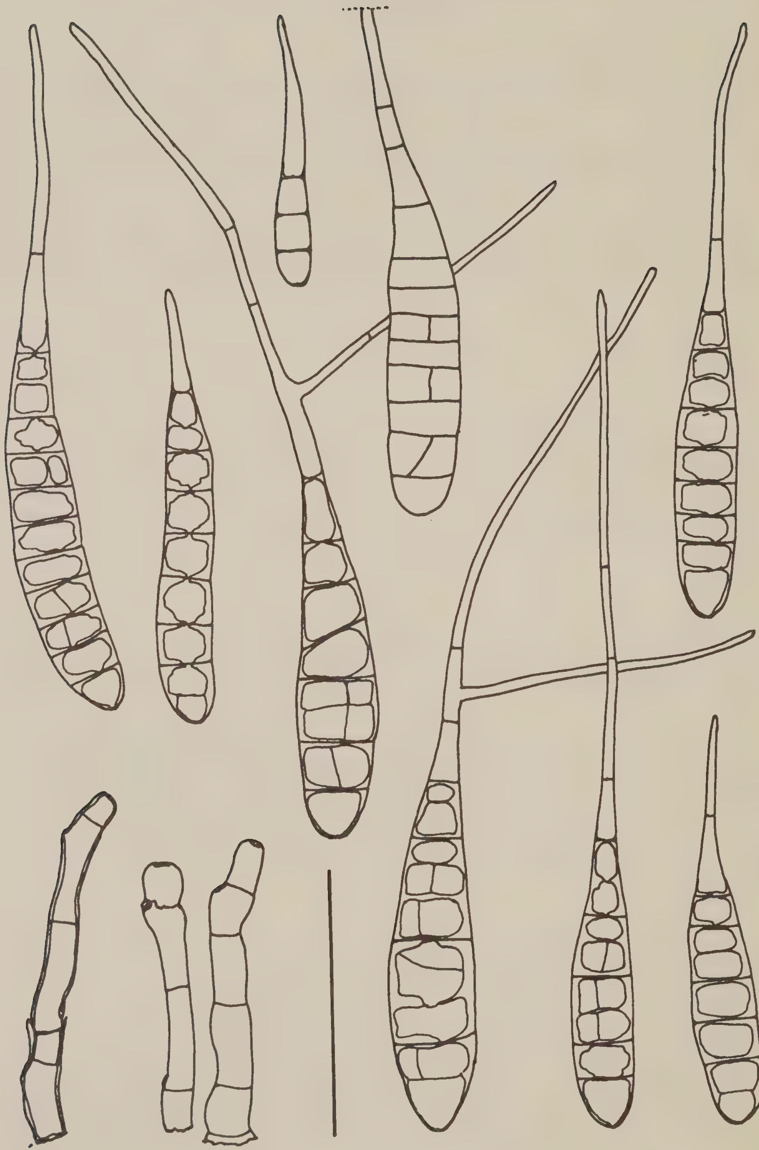

Fig. 131 *Nimbya rhapontici*: conidia and conidiophores ex holotype specimen (EGS 20-169). Bar = 50μm.

Alt.T&V 183-191 Alternaria sonchi species group

183. **Alternaria sonchi** J. J. Davis ex J. A. Elliott (1916), Bot. Gazette 62: 416. Fig. 132

Holotype [**WIS**]: *Macrosporium sonchi n. sp., on Sonchus asper, Madison, Wis., J. J. Davis, Oct.22-1914;* (EGS 01-158).

Elliott presented observations and drawings of spores from cultures obtained from leaf lesions sent to him by Davis. Believing the species to be novel in *Alternaria*, he published a description submitted to him by Davis.

At the time, Elliott was carrying out an extensive review and comparison of *Alternaria* and *Macrosporium* specimens that had been distributed in major sets of exsiccati. He found no specimen similar to *A. sonchi* and, in a major attempt to segregate groups of morphologically similar *Alternaria* species into a manageable classification, proposed "The *A. sonchi* group" (Elliott 1917). His concept was of species "having [comparatively] large-celled spores with a markedly obtuse apex." This is precisely the picture presented by spores of *A. sonchi*, in that ovoid, beakless and apically obtuse conidia within a length range of 80-110μm have several transverse segments (5-8) but only a few inconspicuous longitudinal septa or none, and thus appear to have remarkably large cells.

Conidium size and shape are much the same in both the field type specimen and in cultures. Production of secondary conidia in chains has not been seen in any field specimen available to me, although short chains are of common occurrence in culture. All conidia seen in field or culture have ornamented walls.

Colonies of *A. sonchi* on PCA and V-8 agars are striking in their slow, restricted growth; they reach only ca. 1 cm. in diameter within 10 d. Each colony (at 50X) is a compact felt of erect conidiophores and terminal conidia. There are essentially no nonsporulating aerial hyphae in the most stable isolates. Enlargement of Hay agar colonies is about twice as rapid, with long, erect, uncrowded conidiophores arising directly from the agar surface.

Conidiophores in PCA colonies become ca. 190-300(-550) x 6.5μm, simple or quite commonly truly branched, with each branch terminating in a conidium. Geniculate extension of a conidiophore past the base of a primary conidium is rare. Conidia are solitary or very commonly in chains of 2(-3), oval, apically blunt and beakless, up to ca. 80-90(-100 x 20-29μm for a high percentage of the population, maturing with 5-7 transepta and 0-2(-3) longisepta. The conidium body is conspicuously constricted at several of the transepta; color is a medium yellow-tan; ornamentation is punctulate in juveniles from culture but becomes evenly punctate and eventually verruculose over the entire outer spore wall.

Several isolates from *Sonchus asper* (L.) J. Hill, shared with me in 1995 by the International Mycological Institute, included excellent ones isolated in Canada by C. Jasalovich. IMI 366165 (EGS 43-137), IMI 366167 (EGS 43-131) and IMI 366168 (EGS 43-138) are especially stable in culture.

184. **Alternaria sonchi** F. Stevens (1925), B. P. Bishop Museum Bulletin no. 19: 153.

Lectotype [ILL Mycol. Coll. 14557]: *Alternaria sonchi Stev. n.sp.; Host Sonchus oleraceus; Loc. Oahu, Honolulu; Date 5-9-21; Hawaiian Fungi collected by F. L. Stevens No. 6*; (EGS 08-109).

Stevens listed six Hawaii specimens in his type description. Four of these are represented in herbarium ILL; all except the lectotype are single spotted leaves, and none of them, including the lectotype, has more than a few young conidia. Stevens' description of conidia, "dark brown, muriform, 70 by 11μ, catenulate, beaked when mature," is too meager to be useful; but the conidia seen in reexamination of the lectotype, though mostly immature, are identifiable with ones of typical *A. sonchi* Davis of similar maturity.

185. **Alternaria sonchi** Losa España (1944), An. Jard. Bot. Madrid 4: 203. Fig. 4.

No type specimen has been located. The published illustration is chosen here as lectotype unless a holotype specimen is found (ICBN Art. 8.3, 9.9; Greuter et al., 1994).

Illustrated conidia have the narrow-ovate to obclavate, poorly longiseptate, blunt apex aspect of typical *A. sonchi* Davis. Conidia are described as 90 x 21μm, 4-10 (commonly 6-8) transeptate and constricted, 1-2 longi- or obliquiseptate. The original collection was on living leaves of *Sonchus oleraceus* L. found near Santiago de Compostela, Spain.

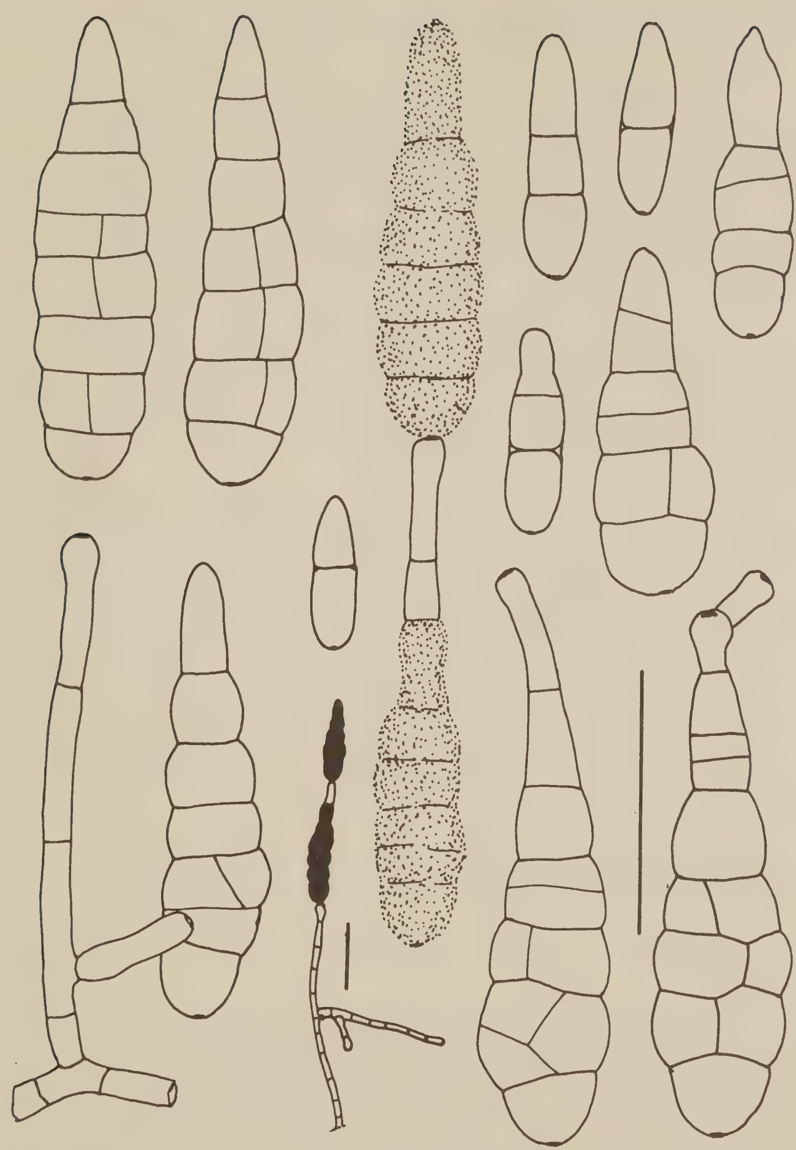

Fig. 132. *Alternaria sonchi* Davis ex Elliott: 2 conidia at upper left ex holotype (EGS 01-158); other conidia and conidiophores ex representative isolate (EGS 43-131), ex PCA. Bars = 50μm

186. **Macrosporium sonchi** Sawada (1958), Bull. Govt. Forest Expt. Sta. 105: 101.

No original collection referable to this name has been found. (It is not among the major portion of Sawada collections held at **TAI**.) The published description was not accompanied by an illustration. Lacking any entity that can serve as lectotype, and with insufficient basis for establishing a neotype, it nevertheless is arguable that Sawada was handling the same fungus as *A. sonchi* Davis. For purposes of discussion, Sawada's type description reads:

Macula sparsa in folio, rotunda, limite indistincta, badia, 5-13mm diam. Conidiophora hypophylla, simplicia, densa, extensa statim ut sporae cadunt, cicatrices laterales, 2-4 septata, 46-85 x 6-9μ. Conidium obclavatum, 4-6 septatum, leviter constrictum apud septa, fulvum, 54-83 x 11-16μ. Hab. in foliis Sonchi oleracei.

Sawada was aware of Davis's earlier description of *A. sonchi* and compared his own measurements of conidia (54-83 x 11-16μm) with those of Davis (80-110 x 18-20μm). In the absence of a Sawada specimen, it is perhaps unsound to speculate on the identity of his fungus except to suggest that the host, conidium size, relatively few transepta, and the lack of mention of longitudinal septa favor identity with *A. sonchi* Davis. Sawada, in his long series of publications, tried to maintain an otherwise widely disavowed distinction between *Macrosporium* (conidia solitary) and *Alternaria* (conidia catenulate), hence his choice of *Macrosporium* for placement of his proposed new species.

187. **Alternaria rudbeckiae** Nelen, ex Nelen and Vasiljeva (1959), Bull. Centr. Bot. Gard., Moscow, 35: 89.

[Transl.]: *On leaves of Rudbeckia hirta, 28.VII, 7 and 18.VIII 1957.*

Though amply described in Russian, a Latin description was not provided, for which reason the name was not published validly in 1959 (ICBN Art. 36.1; Greuter et al., 1994).

188. **Alternaria rudbeckiae** Nelen (1962), Botan. Mater. 15: 150. Fig. 9. Fig. 133

Holotype [**LE**]: *Alternaria rhudbekiae* [sic] *Nelen sp. nova, on Rhudbekia hirta L.*, [translit.]: *Dalnii Vostok, Primorskii Krai, Vladivostok, st. Okeanskaya, D. V. Bot. Sad.*

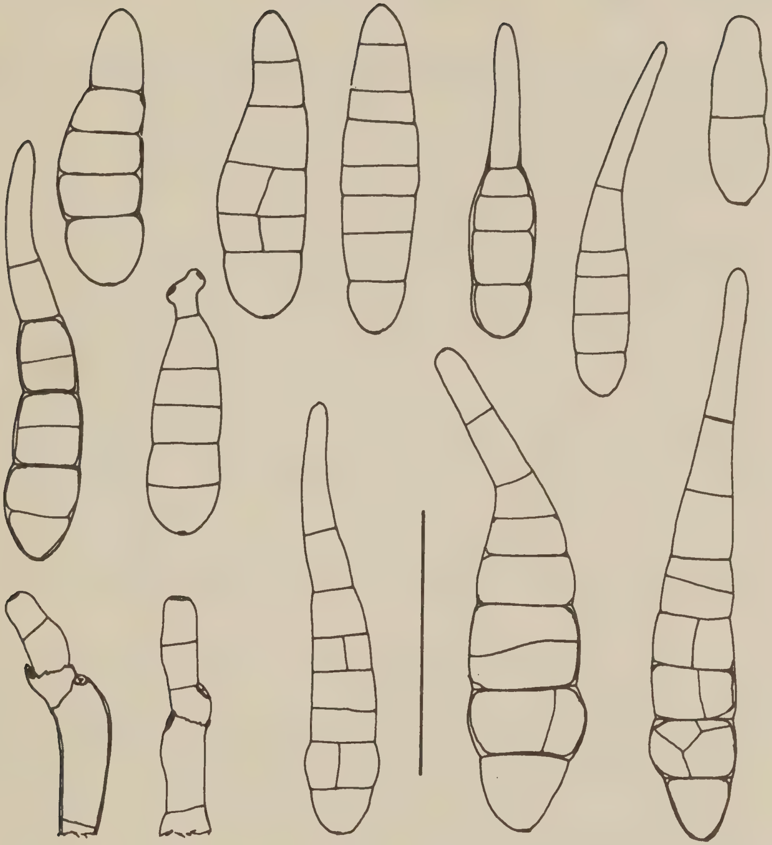

Fig. 133. *Alternaria rudbeckiae*: conidia and conidiophores ex holotype (EGS 20-165). Bar = 50μm.

ANSSSR [Far East, Primorskii Krai [Maritime Terr.], Vladivostok, Okeanskaya Station, Far East Botanical Garden, U.S.S.R. Acad. of Science], *Anno 19 8 VIII 57* [8 Aug. 1957], *Leg./Det. Nelen, E. S.*; (EGS 20-165).

The name was validly published at this time (1962), with Latin description, illustrations of conidia from field and culture, type citation, and type depository. A minor discrepancy, presumed to be without significance, is noted between date of collection in the type description (8 VII 1957) and that on the type herbarium label (8 VIII 1957).

Conidia of the holotype have the *A. sonchi* group appearance of large cells in narrow-ovoid spores with few longitudinal septa and the characteristic blunt, rounded apex. Field conidia of *A. rudbeckiae* have some resemblance to young conidia of *A. cinerariae* in size and shape; but distinguishable older conidia support a two-species concept.

This opinion is based on Nelen's observations and illustrations of conidia produced in his cultures, which retained the narrow (ca. 10-16μm), ovoid to almost elliptical shape seen in field conidia. In contrast, conidia of *A. cinerariae* produced in culture characteristically enlarge dramatically to widths near 30-45μm. In addition, field conidia of *A. rudbeckiae* have comparatively thick, strongly yellow-brown walls in contrast to the paler, thinner walls of *A. cinerariae* conidia.

Nelen described conidia as cylindrical with rounded base and slightly narrowed, broad apex; 70-135 x 10-17μm, with 9-12 transepta and 1-3 longisepta. My observations on the holotype match Nelen's well, noting that largest conidia may be 15-22μm wide and that longisepta characteristically are uncommon in most conidia, occuring in some abundance only in a few of the largest conidia. The slightly tapered, broadly rounded apical part of conidia is a developmental portion of the spore body; it does not become narrowed into a separately definable beak or, in the field material, become converted into a secondary conidiophore. A few small conidia with a well-defined apical secondary conidiophore provide evidence that chains of a few conidia can be produced in nature; this chain character would be expected to be more readily detectable under conditions of artifical culture.

189. **Alternaria cinerariae** Hori & Enjoji ex S. Enjoji (1931), Byōchū-gai Zasshi [Journ. Pl. Protect.] 18(8): 432 [also as p. 36 of sect. 8 of whole vol.18].
Fig. 134

Lectotype [Lab. Plant Pathology, Kyushu Univ., Fukuoka, Japan]: [transl.] *Host Senecio cineraria DC.; Fungus Alternaria cinerariae Hori et Enjoji; Loc. Chiba Agr. Exp. Sta.; Date April 28, 1931; Coll. by S. Enjoji*; (EGS 08-160).

The Hori and Enjoji discussion of a new "ring spot" disease of horticultural cineraria listed collections on 30 March and in April and May of 1931. The Enjoji specimen with an April date (lent to me by H. Yoshii) is selected as lectotype of the species. The type description in Japanese has been translated into Latin by W. Yamamoto (1960), who mistakenly (but most helpfully and with our thanks) considered *A. cinerariae* Hori & Enjoji to be a "nom. seminud." until its description was latinized. (Latin descriptions were not required by ICBN rules until 1 Jan. 1935 (ICBN Art. 36.1; Greuter et al. 1994).)

Alternaria cinerariae Hori & Enjoji was published validly with a date of 1931. It is the correct name for a species that sometimes is cited under a taxonomic synonym *Alternaria senecionis* Neergaard (1945); see *Alt.T&V* 190 below, and ref. Baker and Davis (1950a), Brien and Dingley (1955), a well-illustrated paper by Sobers (1965), Carranza (1966), and Dingley (1969).

Conidia found in the lectotype of *A. cinerariae* and in the type of *A. senecionis* are young but even at that stage have the *A. sonchi* group appearance of comparatively large cells in long-ovoid spores with few longitudinal septa and a blunt, rounded apex. The suggestion that the conidia in these types are young, and therefore not comprehensively representative, follows from examination of isolates of the species in which juvenile conidia duplicate those seen in the types before they develop further into broadly elliptical, muriformly septate, and eventually apically strongly pseudorostrate, catenate spores.

Colonies of *A. cinerariae* on PCA and V-8 agars reach diameters of 6-7cm within 10 d, a growth rate that is ordinary for most *Alternaria* species but which is in sharp contrast to that of *A. sonchi* (ca. 1cm in 10 d). Sporulation on PCA is moderate and scattered, with a moderate amount of nonsporulating aerial hyphae in the colony. Sporulation on V-8 is very abundant, almost dense, with minor nonsporulating aerial hyphae except in the lighter rings of growth produced during dark periods of the daily cycle.

Conidiophores on V-8 mostly are simple, commonly reach a size range of 160-250 x 8μm, and bear a solitary apical conidium. Branching of the primary conidiophore occurs frequently but is not a dominant character of the colony. Conidiophores are produced in such abundance that the aerial population of conidia almost obscures the underlayer of surface hyphae and the erect to ascending conidiophores.

Conidia are predominantly solitary, although 2-conidium chains constitute a significant portion of the population and geniculate branching of a few chains may result in small clumps of 2-5 conidia. Conidia initially are narrowly ellipsoid to ovoid, becoming broadly ellipsoid or ovoid with a rounded apical cell, or obclavate with a short, broadly tapered apical cell, medium yellow-tan, maturing near 160-230 x 32-42μm, with 8-11 transepta and 1-2 longisepta in some of the transverse divisions. Conidia have pronounced constriction at the primary transepta and are laterally symmetrical through early stages of spore development. However, it is characteristic for individual cells or entire transverse sections of maturing conidia to become strongly inflated. This sort of cell hypertrophy may occur in any part of the conidium, has no predictable pattern of development, and is reminiscent of the similar condition found in *A. panax* Whetzel (*Alt.T&V* 10; Simmons 1982).

Representative isolates used in this study include EGS 33-169, ex IMI 225709, from *Cineraria maritima* L., M.A.F.F., Wolverhampton, Staffs., U.K., coll. R. Sandbrook 78/124; and EGS 36-053, ex LEV 20114, from leafspot of *Ligularia* sp., coll. G. Laundon, Horticulture Research Centre, Levin, New Zealand.

190. **Alternaria senecionis** Neergaard (1945), Danish Species of Alternaria and Stemphylium, p. 201.

Holotype [**CP**]: *Alternaria senecionis Neerg.; Senecio cruentus; J. Tylstrup, 30.7.1943, Handelsgartner O. Sørensen; ex Paul Neergaard, Herbarium Phytopathologicum, Type*; (EGS 11-064).

Neergaard's type specimen of *A. senecionis* is on lesions of a selection of host leaves (as an exception among several of his types that are outgrowths, sometimes mixtures, from incubated seed samples). As suggested above for *A. cinerariae* (*Alt.T&V* 189), type conidia of *A. senecionis* are young. However, Neergaard isolated and studied the species in culture. His description and, in particular, his illustrations of conidia (l.c., p. 200) match those of *A. cinerariae* (making allowance for Neergaard's reliance on high-nutrient malt agar growth media). Though validly published, *A. senecionis* Neerg. (1945) is a taxonomic synonym

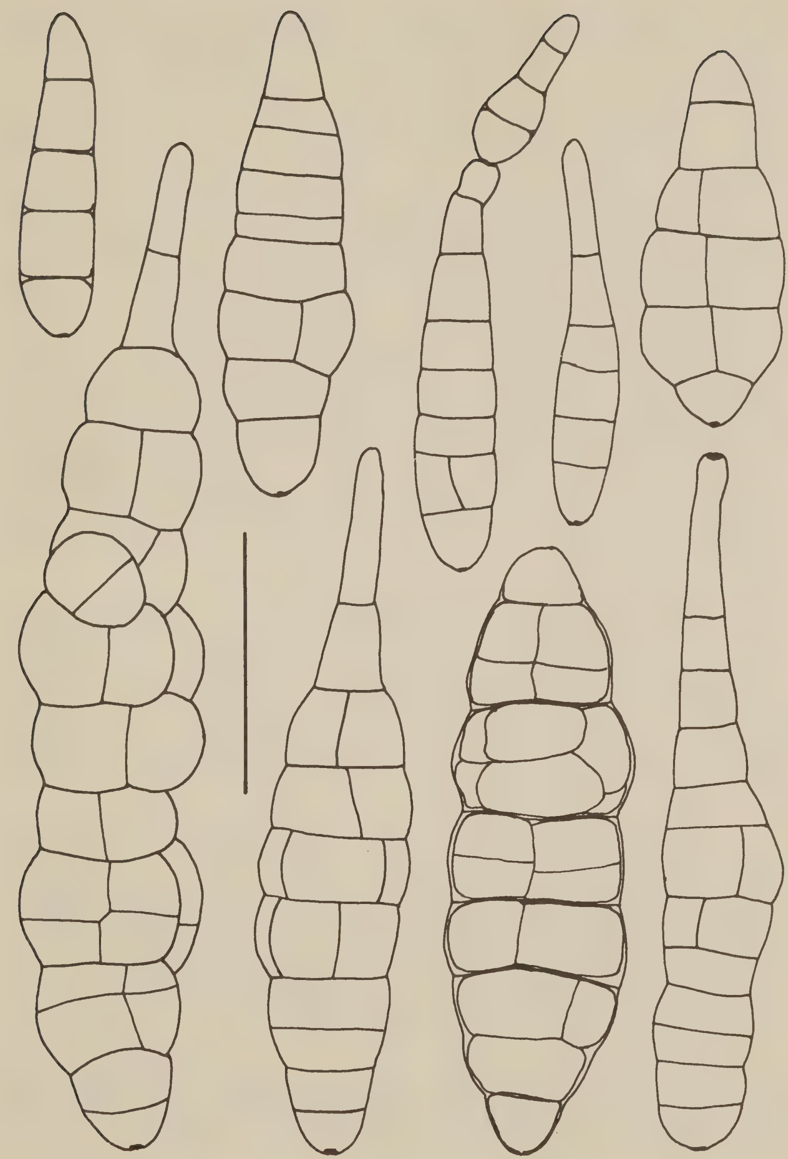

Fig. 134. *Alternaria cinerariae*: conidia ex representative isolate EGS 33-169, ex PCA. Bar = 50μm.

of *A. cinerariae* Hori & Enjoji ex Enjoji (1931), a conclusion also reached by Joly (1964). See *Alt.T&V* 189 above.

191. **Alternaria argyranthemi** Simmons & C. F. Hill, sp. nov. Fig. 135

Ex cultura in agaro PCA descripta. Coloniae e mycelio radiali, subtiliter ramosissimo, atro, constatae, microsclerotiis abundis. Microsclerotia mycelii pluricellularia, atra, tuberculata vel pustulata, vulgo 80-160 x 30µm. Conidiophora simplicia, pauca, sparsa, 0-1 geniculata, ad 25-140 x 2-5µm. Conidia solitaria, primo anguste longiovoidea et lateraliter symmetrica, 50-80 x 16-20µm, 6-10 transeptata; dein 115-225 x 20-28µm, 15-23 transeptata et ex parte 1-2 longiseptata, interdum cellulis infernis diverse inflatis vel microsclerotialibus; conidia laevia, modice luteobrunnea; microsclerotia conidiorum atra, pusticulata. Habitatio typi in foliis Argyranthemum sp., Mount Eden, Auckland, New Zealand. Holotypus: pars ex cultura EGS 44-033 (isol. EGS ex **LYN** *13259, coll. May 1996, C. F. Hill) desiccata et in* **BPI** *749414 conservata.*

The first known collection and isolates of this species as well as subsequent ones are from moribund leaves of *Argyranthemum frutescens* (L.) Schultz-Bip. and related marguerite cultivars in New Zealand (**LYN** 6396, C. F. Hill, Mt. Albert, March 1991 and **LYN** 13259, C. F. Hill, Mount Eden, Auckland, May 1996; EGS 40-056, 44-029/44-034). *A. argyranthemi* sporulates well on the leaves, producing large, solitary conidia without secondary chain formation.

Single conidia are easily isolated and germinated. Resulting colonies on PCA, Hay, and V-8 agars are notable macroscopically as radial, finely branched, rhizoidal mycelium on and beneath the agar substrate. Hyphal growth, initially pale, quickly becomes black as cells of the hyphae (viewed at any magnification of 10X or more) enlarge and develop into pluricellular microsclerotia with densely pigmented and heavily ornamented walls.

The population of enormous numbers of microsclerotia characterizes the spreading-plumose colonies produced on Hay and V-8 agars. Conidia are not seen on Hay, and only a few are found on scattered aerial hyphae above V-8 colonies.

On PCA, however, distinct conidiophores arise directly from the agar surface and produce solitary conidia. Sporulation is sparse, never crowded, but consistently can be found above the microsclerotial colonies. In addition,

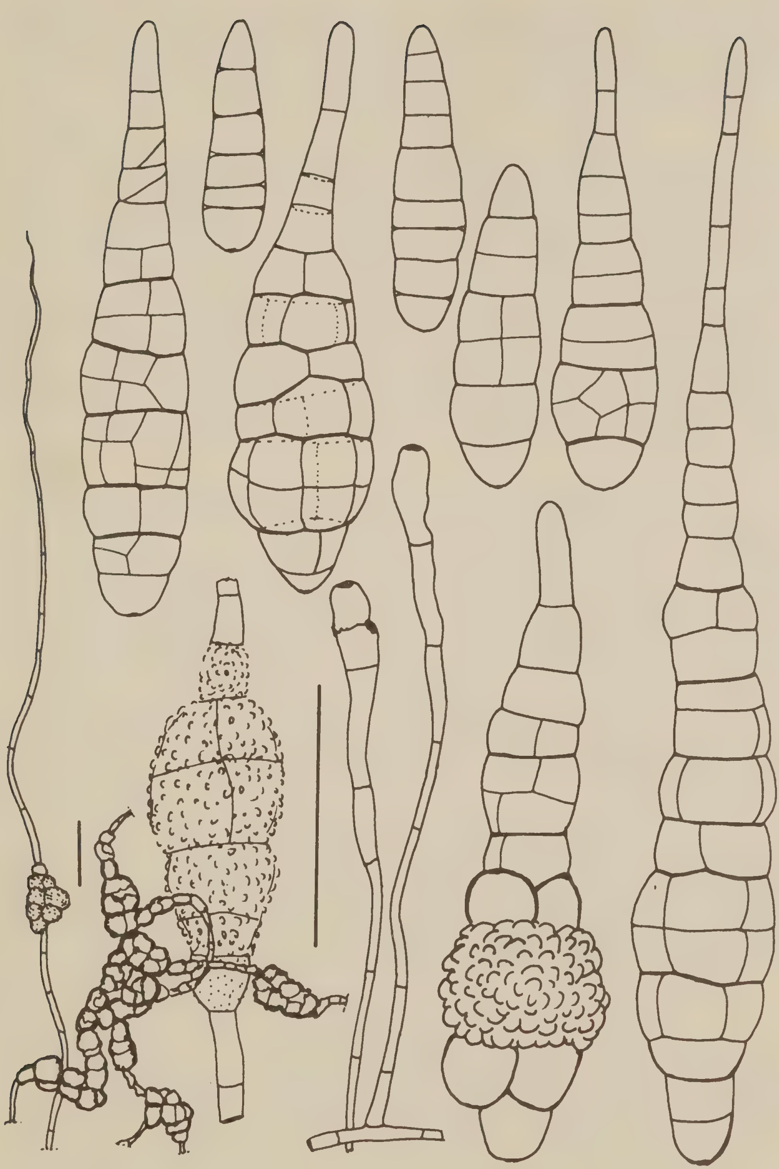

Fig. 135. *Alternaria argyranthemi*: conidia, conidiophores, and microsclerotia ex holotype (EGS 44-033). Bars = 50μm.

scattered, erect, aerial hyphae much longer than the conidiophores arise from the PCA agar surface; these distinctive hyphae often produce an intercalary pluricellular microsclerotium quite distinct from the aerial conidia.

The sclerotium-producing nature of *A. argyranthemi* also becomes evident as individual conidia pass through several stages of growth and septum formation: young conidia have a narrow-ovoid, blunt-apex appearance similar to that of *A. sonchi*; at a later stage, conidia have some resemblance to the broadly tapered, multicellular ones of *A. brassicae* and *A. panax*; then some individual or adjoining cells near the conidium base may become enlarged and additionly septate, as is seen also in *A. panax*; and finally, such hypertrophied cells may become dark and opaque with a wall covering of tubercles or rounded pustules. The morphological result is of readily identifiable conidia converted partially into microsclerotia.

Some conidiophores are seen (at 50X) to arise from vegetative hyphae on the agar surface; others can be traced deeper into the agar substrate, where they originate as branches of subsurface hyphae. The subsurface portion of the conidiophore is narrowed, subhyaline, and fragile (up to ca. 100 x 2-3μm), whereas the emergent apical portion is broader (ca. 25-40 x 5-7μm) and pale tan, with 1 apical conidiogenous site (occasionally 2 in geniculate succession).

The conidium population at ca. 7-10 d contains numerous developing spores in a size range of 50-80 x 16-20μm (6-10 transeptate), as well as a high percentage of fully mature but presclerotial spores in the range of 115-225 x 20-28μm (15-23 transeptate with 1-2 longisepta in the broadest segments). The submedian portion of many conidia becomes swollen (up to ca. 40-50μm diam.) and increasingly septate without becoming sclerotial, while others of the same degree of development produce dark, ornamented, sclerotial enlargements of various sizes, commonly ca. 30 x 30μm.

Conidia are essentially narrow-ovoid (l/w 4:1) and laterally symmetrical with a gradually tapered upper half and a blunt apex. This *Ur*-form eventually is lost as conidia lengthen (up to l/w ca. 7:1), the apical taper elongates, and various segments of the conidium body become swollen. Nonsclerotial conidium walls are smooth and medium yellow-brown.

Erect, scattered, non-conidiogenous aerial hyphae ca. 600 x 5μm sometimes initiate an intercalary microsclerotium about midway of their length. A single hyphal cell is involved initially, as it swells, darkens, and produces wall ornamentation. It is difficult to determine if this single cell enlarges and subdivides in production of the dark, tuberculate microsclerotium ca. 50-70 x 25-35μm, or whether several adjoining cells of the parent hypha are involved in the process. I incline to the latter explanation.

Microsclerotia in the substrate mycelium develop in much the same way, i.e., as enlargements of single or adjoining hyphal cells. Since the substrate mycelium is a branching, sometimes anastomosing network of hyphae, the derivative microsclerotia remain isolated or, commonly, are contorted and branched in a pattern similar to that of the rhizomes of culinary ginger. Individual isolated microsclerotia commonly are ca. 80-160 x 30μm; branching groups often are 300-400μm long and half or more as wide. Fully developed microsclerotia have dark brown-black, essentially opaque, tuberculate or pustulate walls.

Alt.T&V 192-193 The Alternaria helianthi group

Two strikingly erostrate, large-spored species of *Alternaria* described from asteraceous *Helianthus annuus* L. and *Leucanthemum vulgare* Lam. were discussed and illustrated in earlier parts of these notes: viz., *A. helianthi* and *A. leucanthemi* (*Alt.T&V* 19 and 20 respectively; Simmons 1986a). Typifications, comparisons, and synonymies also were noted. The two are reintroduced here only for completeness of coverage in the current paper on species described from Asteraceae.

For grouping and keying purposes it is noted that developing conidia of both *A. helianthi* and *A. leucanthemi* are almost cylindrical (with broadly rounded base and apex) until they begin inserting longitudinal septa in some of their enlarging transverse segments. Additionally, they are completely erostrate, only rarely initiating a secondary conidiophore and conidium.

192. **Alternaria helianthi** (Hansford) Tubaki & Nishihara (1969), Trans. Brit. Mycol. Soc. 53: 148.

≡ *Helminthosporium helianthi* Hansford (1943), Proc. Linn. Soc. London 155: 49.

Holotype [**IMI** 5754]: *Helianthus annuus, Kampala, Uganda, C. G. Hansford 910, March 1928*; (EGS 27-072).

See *Alt.T&V* 19 (Simmons 1986a) for discussion and illustration.

193. **Alternaria leucanthemi** Nelen (1962), Botan. Mater. Gerb. Bot Inst. Kamarova Akad. Nauk SSSR 15: 148; fig. 9 (p. 149).

Lectotype: Nelen illustration (Fig. 6, p. 149), as the type specimen is believed to be missing (ICBN Art. 8.3, 9.9; Greuter et al., 1994).

= *Alternaria chrysanthemi* Simmons & Crosier, ex Simmons (1965), Mycologia 57: 142.

See *Alt.T&V* 20 (Simmons 1986a) for discussion and illustration.

Alt.T&V 194-223 Alternaria species producing conidia with filiform beaks

Many of the 27 *Alternaria* species accepted here from Asteraceae have long conidia in the 100-200+μm range (spore body plus filamentous true beak). It is surprising to find that not until 1886 was a description published that represents one of these large-spored species (*Macrosporium readeri* Winter, on artichoke); and that not until 1903 did a second one appear in the literature (*Sporidesmium scorzonerae* Aderhold, on salsify). It is possible, of course, that some alternarioid species published earlier as *Sporodesmium* or *Helminthosporium* may have escaped attention, although promising material of those genera has been checked routinely during searches through stacks of *Macrosporium*, etc., herbarium folders.

The 17 recognizable species with abruptly narrowed or filament-beaked conidia are considered below in an order approximating the increasing size of the spore body, initially by length, secondarily by width within similar length groups.

Initial attempts to segregate the species into keyable, limited groups (e.g., conidia solitary, in chains, beaks multiple, beaks branched, etc.) proved untenable and impractical of presentation without continual reference to exceptions. The reason is that *Alternaria* conidia maturing with a complex morphology or sporulation pattern will, of course, have developed through several simpler stages, all of which are likely to be present in abundance in any sampling of a spore population from undisturbed cultured colonies.

For example, chain formation can be induced to some extent in most, probably all, species of *Alternaria* that are described from field material as being non-catenulate; it requires only that a conidium be induced to produce a secondary conidiophore, which may occur rarely in nature but readily under culture dish conditions.

Also, strong emphasis must be placed on the problem of categorizing *Alternaria* species that are typified from nature as producing solitary conidia with a single unbranched filiform beak. A few species found with this simple morphology in field material retain the same appearance in culture (e.g., *A. helianthinficiens*, with secondary conidia extremely rare). Most, however, also will produce at least a few secondary conidia in culture (e.g., *A. zinniae*). Some also will advance one step further, producing one-branched beaks occasionally or even commonly among the basic population of simple-beaked spores (e.g., *A. calendulae*). And a few will develop even further in production of multiple beaks on a detectable but minor portion of the conidium population (e.g., *A. scorzonerae*, *A. cichorii*).

Each of the species examples cited above usually has conidia (if any) in only the least elaborated form in field collections, and it cannot be predicted, without foreknowledge, just which species will produce conidia of which pattern under the enhancing conditions of artificial culture.

The greatest degree of conidium complexity mentioned below in treatments of individual species is an indication of the maximum diversity observed. This can be a useful species and keying character, but it often refers to only a relatively small portion of the population present under specified conditions of culture and age.

194. **Alternaria enydrae** S.A. Khan & M. Kamal (1974) [as "*enhydrae*"], Mycopath. Mycol. Appl. 52: 30.
Fig. 136

Holotype [**IMI** 124352]: *on Enhydra [Enydra] fluctuans, Jati, Distr. Thattor (W. Pakistan), Coll. Shakil Ahmed Khan, 12 Oct. 1966; Phytopath. Herb. Agr. Res. Inst., Tando Jam (W. Pakistan) no. 344* [isotype?]; (EGS 22-064).

The type description and accompanying illustration of *A. enydrae* define a species having solitary conidia with an unbranched filamentous beak. Review of the type material at IMI confirms the observations of the original authors.

Conidiophores on the host are inconspicuous and simple, ca. 20-25 x 4-5μm, with 1-3 conidiogenous sites produced consecutively. Sporulation in nature, therefore, was solitary or in clumps of 2-3 conidia.

Young ovate conidia begin to produce a narrow beak at an early stage, when transverse septa are being initiated but usually before longitudinal septa are visible. The conidium body retains an ovate outline into maturity, becoming 5-7 transeptate and 1-2 longiseptate in 1-4 of the median transverse sections. The outer wall is smoothly undulate over developing distoseptate cells, becoming sharply constricted at some eutransepta as they are laid down in the broadest conidia. Medium yellow-brown conidium bodies reach ca. 45-50 x 13-15μm and taper apically into a straight to slightly flexuous beak ca. 40-90 x 1-2μm.

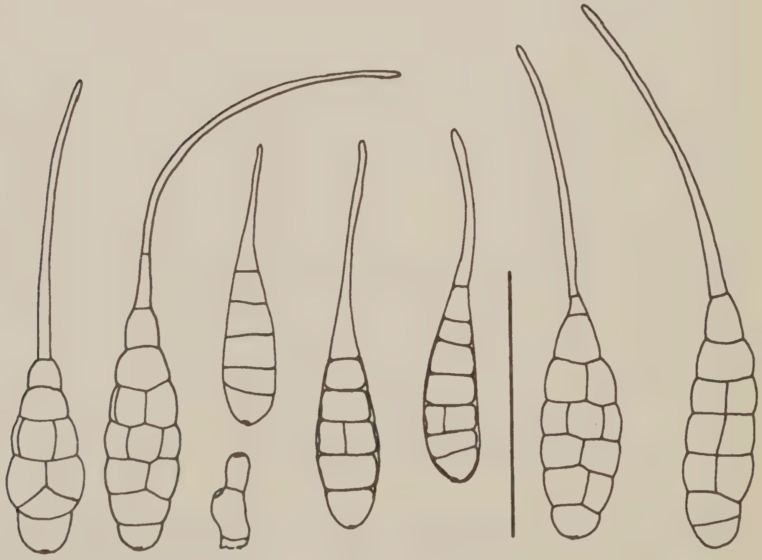

Fig. 136. *Alternaria enydrae*: conidia and conidiophores ex holotype (EGS 22-064). Bar = 50μm.

195. **Alternaria helianthinficiens** Simmons, Walcz & Roberts, ex Simmons (1986a), Mycotaxon 25: 204.

Holotype [**BPI** 446365]: dried culture preparation of *EGS 36-184, ex R. G. Roberts isolate from seed of Helianthus annuus L., North Dakota, U.S.A.*

Alternaria helianthinficiens (*Alt.T&V* 17) is given an entry here to keep it with other asteracicolous species for comparison purposes. The original description, based on V-8 cultures, does not require significant modification, although a few comments will bring observations forward 10+ years.

Primary conidiophores were described originally as arising in an uncrowded stand directly from surface hyphae. However, as colonies age, and certainly within two weeks, an open upper story of abundant, very long, erect, ascending or arching conidiophores develops. These long conidiophores typically bear short lateral branches at intervals along their length, each of which bears a single conidium (mostly) or a 2-spore chain (rarely).

The internal septation pattern of *A. helianthinficiens* conidia originally was described as "peculiar and characteristic," giving an "overall impression...of 15-20 small bubbles or balloons (the cell lumina) bulging, crowding, and overlapping within the general confines of the outermost wall." The impression has not changed, but my current practice would be to describe it in terms of distoseptum and euseptum formation within the spore body, as I began to do in 1996 for other species (*Alt.T&V* 145-149, pp.406-408).

Although eusepta are produced in conidia of *A. helianthinficiens* (seen most easily in immature spores), most cells of mature conidia are separated only by distosepta. These cells appear as crowded, bulging spheroid lumina within the confines of the outer wall; they effectively distort or obscure any transverse eusepta that are formed.

196. **Macrosporium centaureae** Roldan (1938), Philippine Journ. Sci. 66: 9.

Lectotype: Roldan, l.c., Plate 3, fig. 4, from specimen *E. F. Roldan 41, June 12, 1936, on living leaves of Centaurea sp., College of Agriculture campus, Luzon, Laguna Province, Philippines*. The specimen is reported to have been lost (**CALP**, T. Quimio, in litt. May 1996), hence the choice of Roldan's published illustration as lectotype (ICBN Art. 8.3, 9.9; Greuter et al., 1994).

Conidia of *M. centaureae* were described as "subclavate [subobclavate?], olive brown, 42 to 122 x 12 to 17μ, stipitate [probably to be read as "beaked"], submuriform, 4 to 12-septate."

Illustrated conidia may represent a species of *Alternaria* with narrow-ellipsoid spore bodies up to ca. 68.4-77.7 x 11.4-13.8μm plus filamentous beaks ca. 41.1-43.5μm and with 6-9 transepta and 1-2 longitudinal or oblique septa in one of the central segments. The conidia may be interpreted just as readily as a species of *Nimbya*, and particularly so in that they appear to have been drawn as being distinctly distoseptate without a suggestion of euseptum formation.

A genus choice cannot be made for *M. centaureae* as long as the original specimen is lacking, and certainly no very precise species characterization is possible.

As a final note in aid of anyone examining Roldan's original publication, the legend of the type illustration indicates that enlargement of the sporulation elements is "X1314." This is an error that fails to account for a reduction in publication to ca. 1/3 of the original, if conidium measurements in the printed description are accepted as correct. The legend should read ca. **X438** to accomodate the discrepancy.

197. **Alternaria argyroxiphii** Simmons & Aragaki, sp. nov.

Fig. 137

Ex cultura in agaro PCA descripta. Conidiophora simplicia vel 1-2 geniculata vel ramosa, ad 140-290 x 5.5μm. Conidia solitaria vel 2-3(-6) catenata. Conidia primaria longiovoidea, 7-10 transeptata et 1-2 longiseptata, 70-90 x 19-21μm, luteobrunnea, punctulata vel punctata, rostro singulo filiformi ad 300-350(-500) x 2μm etsi vulgo ca. 200μm longo. Conidia secondaria 20-40 x 10-15μm, rostro filiformi ad ca. 65μm.

*Habitatio typi in Argyroxiphium sp., Haleakala, Ins. Maui, Hawaii, U.S.A. Holotypus: pars ex cultura EGS 35-122 (isol. M. Aragaki no. 127, Haleakala, Maui, 1969) desiccata et in **BPI** 749415 conservata.*

The original isolate was from a specimen of Haleakala silversword on Maui Island, Hawaii. It is one of several excellent isolates of *Alternaria* shared with me over the years by colleague Minoru Aragaki, University of Hawaii, and has remained culturally stable with excellent sporulation

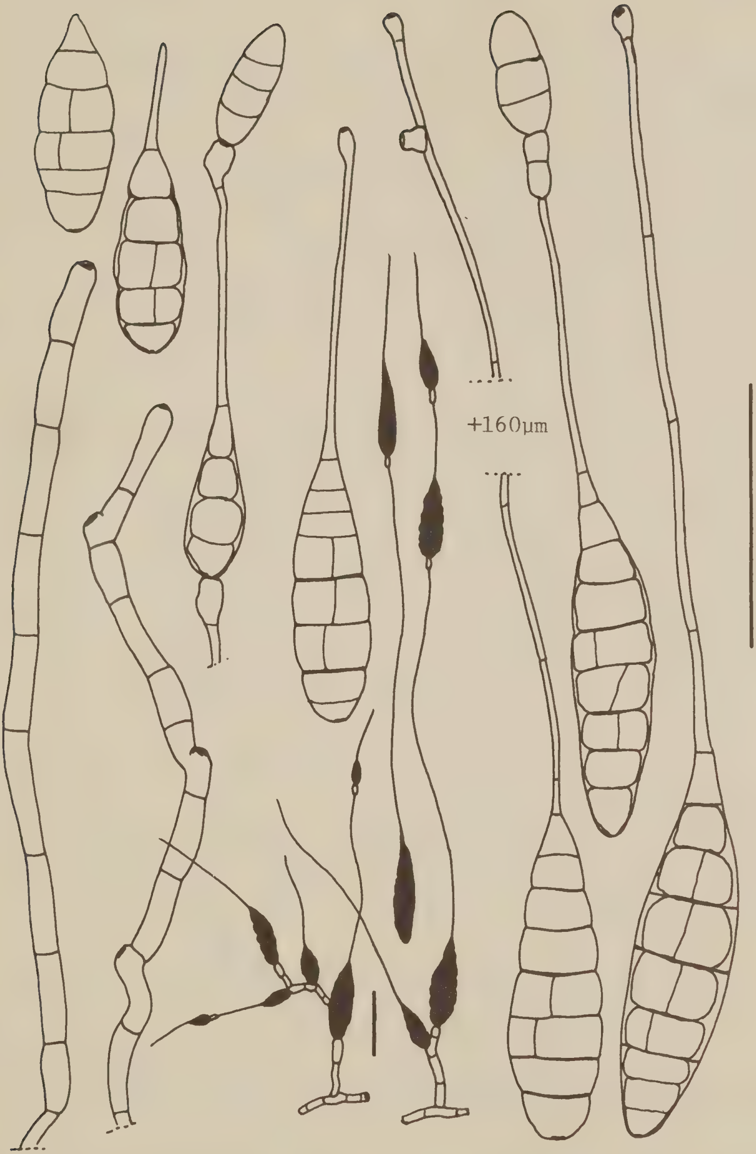

Fig. 137. *Alternaria argyroxiphii*: conidia and conidiophores ex holotype (EGS 35-122). Bars = 50μm.

throughout the 27+ years since its original isolation.

Conidiophores arise in great numbers directly from substrate hyphae. They are erect and simple with a single apical conidiogenous site or very commonly are 1-2 geniculate and conidiogenous at 2-3 sites. Sometimes the primary conidiophore produces a tight system of branching and geniculate extension with numerous conidiogenous sites and a resultant complex of 10-20 solitary and catenate conidia. In most cases the primary conidia have a long to extremely long filiform beak. Secondary conidia in chains of 2-3(-6) units also have filiform beaks, but these are much shorter than those of primaries. The close stand of conidiophores and primary conidia arising from the agar surface may become obscured by considerable amounts of aerial sporulation.

Juvenile primary conidia are ovoid, or ellipsoid soon becoming ovoid. An apical beak may be initiated at any young stage, but it usually begins development when the spore body is ca. 35-45 x 15μm. The fully developed spore body of primary conidia is long-ovoid or ellipsoid, reaches a range of ca. 70-90 x 19-21μm, and has 7-10 transepta plus 1-2 longisepta in a few of the transverse divisions. Conidium bodies no more than 7d. old are mostly distoseptate; eusepta are laid down through some of the distosepta as the conidia age. Conidia are medium yellow-tan with an evenly punctulate to punctate surface ornamentation. The filiform beak of primary conidia may reach dimensions of 300-350(-500) x 2μm, although the usual length range is ca. 100-200μm.

A primary conidium rarely produces a robust secondary conidiophore directly from its apical body cell. Instead, each secondary conidiophore is a distinctive swollen region ca. 11-17 x 5.0-5.5μm at the tip of the long filiform primary beak. Secondary conidia usually remain relatively small, 20-40 x 10-15μm, and either lack a beak or have a filiform beak up to ca. 65μm long.

198. **Alternaria steviae** Ishiba, Yokoyama & Tani (1982), Ann. Phytopath. Soc. Japan 48: 46. Fig. 138

Holotype [**IFO** H-11843]: *Stevia rebaudiana Bertoni, Harada-cho, Zentsuji, Kagawa, viii, 1978, C. Ishiba, Kagawa-a*; isolate ex-type, **IFO** 31182 (EGS 37-019).

The ex-type isolate of *A. steviae* grows well on PCA and V-8 agars and sporulates prolifically in colonies composed almost entirely of dense stands of conidiophores and conidia. Non-sporulating hyphae are not prominent.

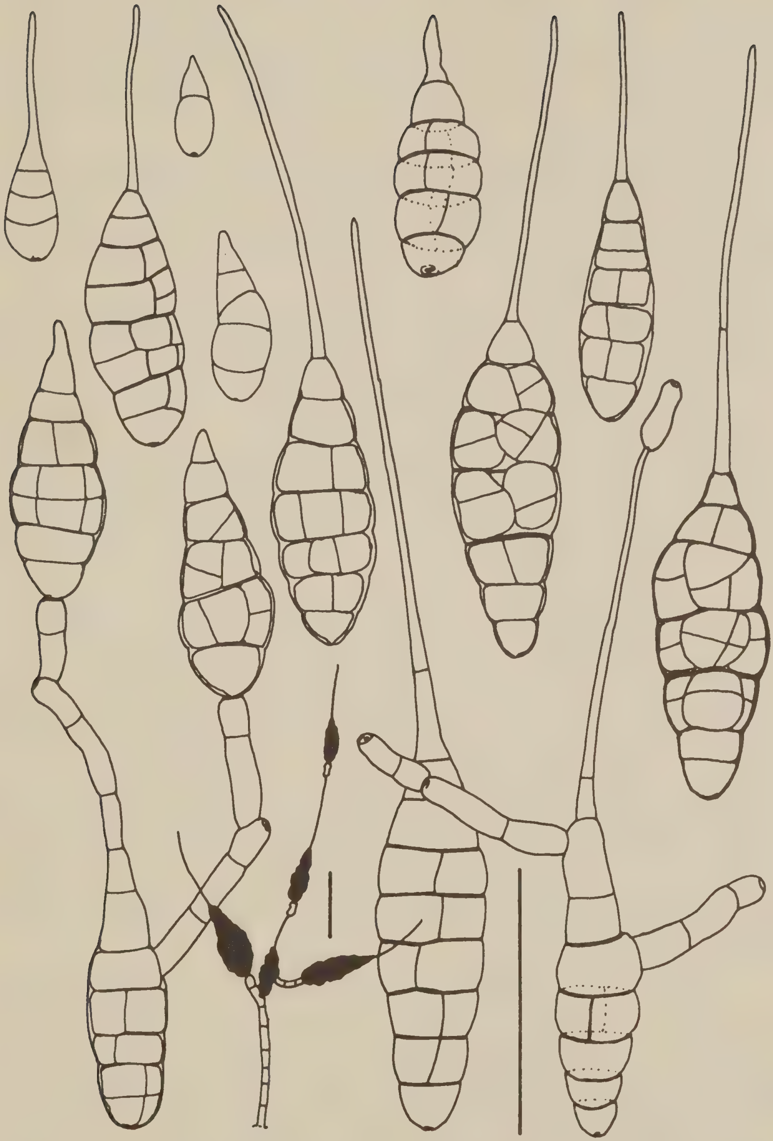

Fig. 138. *Alternaria steviae*: conidia and conidiophores from ex-type isolate (EGS 37-019). Bars= 50μm.

The type study of *A. steviae* indicates that the long filament-beaked conidia are mostly solitary, with 2-spored chains rarely produced. The ex-type isolate, however, reveals a tendency in PCA cultures for the filamentous beak of the primary conidium to be converted apically into a secondary conidiophore or for a beakless conidium to produce a secondary conidiophore from its apex or from one or more lateral cells. The result is short chains of two or three conidia. Additionally, the primary conidiophore often produces both conidiogenous branches and short geniculate extensions, resulting in small clumps of ca. 7 solitary and catenulate conidia.

Colonies on PCA become composed almost entirely of such clumps of conidia borne aloft on sturdy conidiophores; simple conidiophores with a single apical conidium become exceptions in the population as the colony matures beyond ca. 10 d. Similar chains and clumps are abundant within the very crowded sporulation turf on V-8 agar, although simple conidiophores bearing a single conidium make up by far the major part of the V-8 colony. Conidia mature in PCA and in V-8 colonies with somewhat different morphologies and dimensions, as follows.

Conidia produced on PCA undergo internal septation quickly and abundantly, at first with well-defined primary transepta, but then with longitudinal and oblique walls in unpredictable number and order. The basic ovoid or ellipsoid shape of the conidium body does not become distorted (in contrast to that of *A. panax*; *Alt.T&V* 10, Simmons 1982). The internal secondary septation, mostly distoseptate, appears almost random without disguising the position of the primary transverse septa. Spore bodies of PCA conidia may mature singly or in chains at almost any size up to a high range of ca. 56-72 x 16-29µm. The filiform beak, when present, is ca. 64-80(-140) x 2.5µm. There are 6-8 major transepta, whose color becomes a medium to dark golden brown. Spore walls are smooth or punctulate.

Conidia produced in V-8 cultures retain a basic undistorted long ovoid or ellipsoid shape into maturity, with 6-8 major transverse walls, some or all of which become eusepta. Most conidia become longitudinally 1-septate in a few of the transverse segments, but only a minor portion of them become abundantly cellular through insertion of additional transverse, longitudinal, and oblique secondary walls. Mature conidium size is concentrated in a range of ca. 75-80 x 22-24µm plus a single filiform beak ca. 70-110 x 2.5µm.

199. **Alternaria cichorii** Nattrass (1937), A First List of Cyprus Fungi, p. 29. Fig. 139

Holotype [IMI 1007]: *Alternaria cichorii Nattrass, ex Type Coll., Nattrass No. 144, Nicosia, 21-12-31*; (EGS 10-036).

Nattrass described and illustrated in fine detail conidia of a leaf parasite of chicory, *Cichorium intybus* L., in Cyprus. His illustrations were from both the field specimen and, most helpfully, from a derivative isolate grown as an agar culture. Typical conidia were presented as having long-ovoid to fusoid-obclavate spore bodies that taper gradually into a long filiform beak, which usually is unbranched but often, according to Nattrass, is 1-branched. Dimensions of field conidia were given as 60-130 x 14-20μm (spore body) plus a filiform beak up to 280μm long.

I have seen conidia with branched beaks, rarely, in only one field specimen of this species, viz., a second Cyprus collection from Nattrass dated 6 Feb. 1932 (EGS 05-196). Isolates of the species in culture, however, give a decidedly different picture, both in Nattrass's hands and in mine, by producing an abundance of conidia with a beak branched near its base or often with second and third branches, and thus a total of four filiform beaks. There also is evidence of sparse secondary sporulation in chains of two conidia. Classification of *A. cichorii* among morphologically similar species is, therefore, as with most *Alternaria* species, a balancing act requiring an appreciation of likely field conditions (in the case of static type and survey specimens) as well as a continuum of observations on sporulation and individual spore development in culture. The following description is based on an isolate IMI 225641 (EGS 33-168) that probably originated in Greece.

Conidiophores in 7d. PCA cultures are robust, ca. 7μm at the base and enlarging toward the conidiogenous apex to ca. 9μm. Primary conidiophores commonly have lengths in the range of ca. 10-100μm, and frequently are branched or geniculately proliferate near the apex.

Juvenile conidia initiate beak formation at a very early stage, often when the spore body is only ca. 15 x 10μm and has only one or two cells. Elongation of the beak is rapid, reaching maximum length before conidium bodies can be said to be fully developed. Mature conidia with only a single filiform beak are plentiful, the body ca. 90 x 18-20μm + beak up to ca. 150 x 3μm. Conidia with 2-3 additional beaks are even more plentiful; individual beaks of a branching or multiple system are ca. 65-100μm long, i.e., usually shorter than those that develop without branching. Chain formation is not a usual condition, although an occasional erostrate spore body is found with a terminal simple or geniculate conidiogenous extension.

Internal wall formation is almost entirely distoseptate in conidia from 7d. cultures (and in young field conidia). Mature conidia have 7-12 transverse distosepta, with eusepta laid down through only two or three of these in the oldest conidia (but more in field conidia). Longitudinal septa are rare under conditions of plate culture. Nattrass (l.c., Pl. XIV, p. 71) drew one longitudinal septum in each of 1-2 cells of field conidia and none at all in conidia produced on agar cultures; at least one large conidium in his 1932 specimen has a single longitudinal septum in each of 6 of its 11 transverse segments.

In addition to the Nattrass holotype specimen and a second one by him from Cyprus, mentioned above, identifiable collections of *A. cichorii* known to me are from New Guinea (EGS 23-016 and 23-017 = **IMI** 75026 and 76088, both dated 1957); from West Pakistan (EGS 23-19 = **IMI** 118504a, d.1966); from Egypt (EGS 23-020 = **IMI** 119509, d.1966); from Florida, U.S.A. (EGS 02-091 = **NY**, G. F. Weber 7513, d.1932); from Greece(?) (EGS 33-168 = **IMI** 225641, d.1978). All are on species of *Cichorium*, usually *C. intybus* L. or *C. endivia* L.

200-204. Names in **Macrosporium and Alternaria** for species described from *Carthamus tinctorius* L.

New species names for *Macrosporium/Alternaria* on leafspots of safflower, *Carthamus tinctorius* L., have reached publication in five different formats. Each of these is discussed below in chronological order of publication. The correct name for the taxon in *Alternaria* is *A. carthami* Chowdhury (*Alt.T&V* 202).

200. **Macrosporium carthami** Rodigin (1939), Annals of the Saratov Agric. Inst., ser. 2, 1: 190 [sometimes cited as vol. "6: 190" of the whole series].

The type specimen has not been found; no illustration was published with the type description. The Rodigin species is unidentifiable without an authentic specimen of some sort. Rodigin's type description is given below for the record and minor comment.

"*Maculis cinnamomeis, irregularibus, confluentibus,*

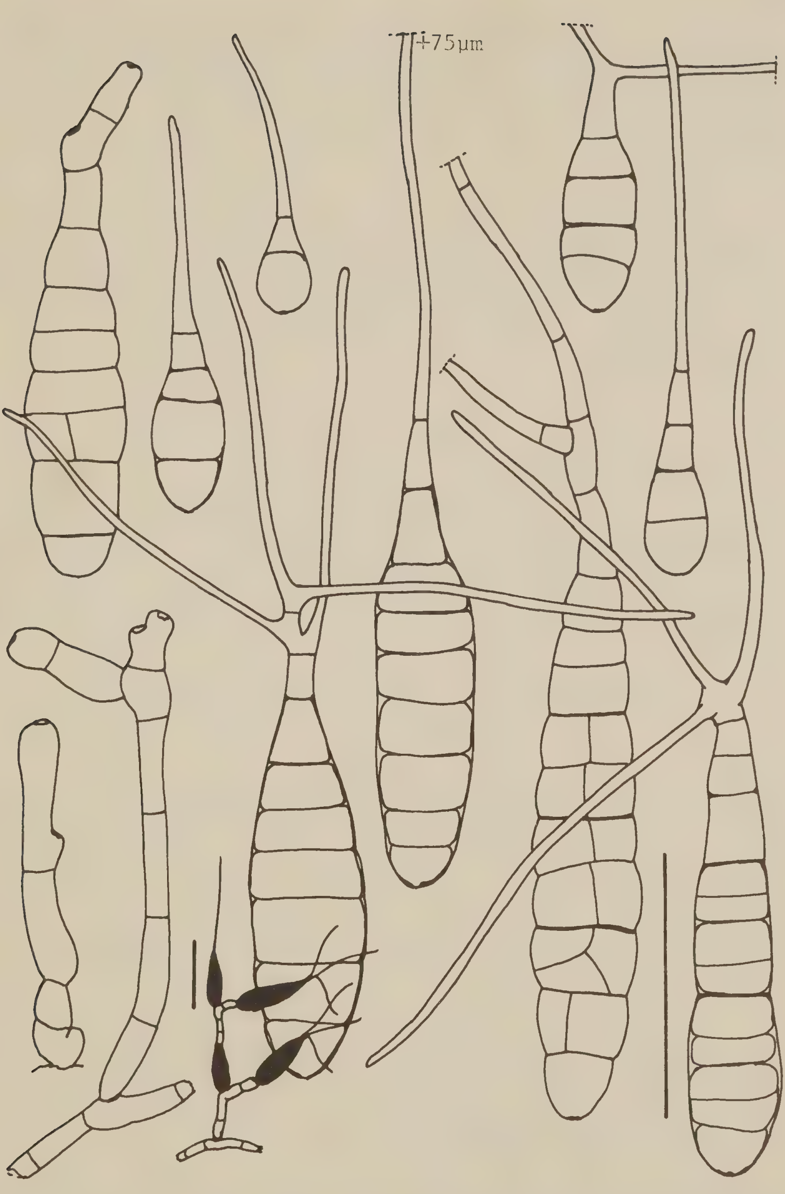

Fig. 139. *Alternaria cichorii*: conidia and conidiophores ex representative isolate (EGS 33-168), ex PCA. Bars = 50μm.

amphigenis, tomento nigro velitino. Conidiophoris fascilulis parvis, formentibus, cinnamomeis, 80-124/4μ. Conidiis clavatis vel fusoides, olivaceis, 6-12 transverse septatis, 58-74/11-14μ. Hab. in foliis vivis Carthamus tinctoriis; Uljanowsk, 19/VII-1935, leg. Leontjeva, J. [all spellings 'sic']."

The relatively small size of conidia (58-74μm long) without any mention of a conidial beak makes it impossible to compare Rodigin's fungus with those *Macrosporium/Alternaria* species described later by other authors from the same host species. The other published names, discussed below, all represent *Alternaria* species with narrowly tapered conidium beaks.

201. **Macrosporium carthami** T. Săvulescu (1942), Bull. Sect. Sci. Acad. Roumaine 25: 22.

Lectotype [**BPI**; Tr. Săvulescu, Herbarium Mycologicum Romanicum, Fasc. XXVII, Nr. 1339; publ. 1947]: *Macrosporium Carthami Săvulescu Tr.,...Muntenia, distr. Ilfov—Bucureşti, 20.IX.1940...Sur les feuilles et les bractés vivantes de Carthamus tinctorius L....Leg. et det. Tr. Săvulescu*; (EGS 44-028).

Săvulescu described narrow-beaked conidia of his *M. carthami* as reaching lengths mostly around 75-90μm with a maximum of 115μm (and illustrated one at ca. 130μm). Most conidia seen in reexamination of his type specimen are immature, and thus match his stated common dimensions of 75-90 x 15-18μm, including a tapering beak 10-40 x 5-6μm. The largest conidium found in review of the lectotype is 145 x 18μm (incl. 65μm beak). Săvulescu drew conidia as distinctly distoseptate. All of the type conidia seen show this character, with 4-5 transverse eusepta being evident only in the largest conidium, which has 11 transverse segments.

Conidia are very difficult to find on portions of the type gathering of *M. carthami* that Săvulescu distributed in the cited exsiccata (**BPI** (EGS 44-028); **NY** (EGS 03-085)), but those seen, as indicated below in *Alt.T&V* 202, are not distinguishable from those of *A. carthami* Chowdhury, of which *M. carthami* is a taxonomic synonym.

The name *M. carthami* Săvulescu (1942) is a later homonym of *M. carthami* Rodigin (1939), and therefore is illegitimate (ICBN Art. 53.1; Greuter et al., 1994). Neither the unrecognizable species *M. carthami* Rodigin nor the *Alternaria* species described as *M. carthami* Săvulescu can be transferred to *Alternaria* because of priority of the validly published *Alternaria carthami* Chowdhury (1944); cfr. ICBN rules on homonymy (ICBN Art. 53.1; Greuter et al., 1994).

202. **Alternaria carthami** Chowdhury (1944), Journ. Indian Bot. Soc. 23: 65. Fig. 140

Holotype [**HCIO** 12545]: *Type, No. 12545, Alternaria carthami Chowdhury; Hab. Carthamus tinctorius; Loc. Pusa, Bihar, 7.1.1936; Coll./Det. S. Chowdhury*; (EGS 29-122).

= *Macrosporium carthami* T. Săvulescu (1942); cfr. *Alt.T&V* 201.
= *Macrosporium anatolicum* A. Săvulescu (1944); cfr. *Alt.T&V* 203.

Chowdhury's description of a leaf and stem parasite of safflower included conidium dimensions of 36-99 + 12-84μm (spore body + filiform beak), indicating lengths about 20% greater than the maximum found for those in the type of *M. carthami* T. Săvulescu. However, reexamination of Chowdhury's type specimen shows that most conidia seen are in fact near in size to those of the Săvulescu type. It is equally noteworthy that conidia seen in Chowdhury's specimen are practically duplicates of Săvulescu's illustrations, and that the distoseptum character drawn by Săvulescu is quite pronounced in Chowdhury's type specimen.

Other characters, particularly the nature of beak development (discussed below), contribute to an opinion that the type materials from Romania and from India are of the same *Alternaria* species, with *A. carthami* Chowdhury the correct name.

It is noted that Chowdhury's published illustrations (l.c., fig. 1), indicated in the legend to be "X520," are more nearly **X260** if they are to correspond with dimensions given in the type description.

Collections of heavily spotted leaves of *Carthamus tinctorius* (safflower) reached me in July 1973 from E. E. Burns (University of Montana, Bozeman). No conidia could be found on the lesions, but nearly every spot held overnight in a damp chamber yielded excellent crops of narrow-beaked conidia. These conidia are identifiable as *A. carthami*, having mature lengths ca. 200μm (max. spore body 96 + beak 128 = 224μm). Isolate EGS 31-037 from the Montana specimen is a good representative of the species.

Sporulation on PCA is abundant from surface hyphae, rather dense near the center but less crowded as the colony spreads. Primary conidiophores are robust, commonly ca. 80-115 x 5-8μm, often with 1-2 apical sporogenous geniculations and occasionally 1-2 lateral branches; thus, conidia may occur in small clumps as well as remaining solitary.

It appears tht conidia can take two slightly different paths of development into maturity. Some may be narrow-ellipsoid when very young, and retain this relatively narrow form through stages of enlargement, septum formation and beak elongation.

Other young conidia are broadly ovoid, sometimes almost sphaeroid, ca. 32-38 x 18-23μm. These produce a strongly differentiated, sturdy, apical extension about 5μm wide and with 2-3 transepta. The extension broadens as the spore body enlarges and, at maturity, appears as an upper, tapering, septate portion of the broadly ovoid conidium body. The characteristic filiform true beak arises at the apex of this unusual extension of the spore body.

Mature conidia from PCA cultures are either narrowly ovoid to ellipsoid or broadly ovoid, depending on path of development, dull yellow-tan, with spore bodies usually reaching an upper range of ca. 70-88 x 20-28μm, with 7-9 transverse distosepta, across 1-2 of which eusepta may form, and 1 longiseptum in 1-2 of the transverse segments. The outer wall characteristically is strongly ornamented, almost verruculose in youth, becoming punctate over about the lower two-thirds at maturity. All conidia produce at least one filiform beak; two are very common, and three not at all rare. Evidence of chain formation (a secondary conidiophore) is very rare. Conidia in young V-8 colonies do not differ markedly from those in PCA except that they tend to reach a slightly greater maximum width (up to ca. 32μm) and characteristically do not have multiple beaks.

203. **Macrosporium anatolicum** A. Săvulescu (1944), Bull. Sect. Sci. Acad. Roumaine 26: 709, fig. 5B.

Lectotype: A. Săvulescu's illustration, fig. 5B, published with the type description (l.c., 1944).

Attempts to locate type material of this name in institutions of Romania, where Săvulescu worked, and Turkey, the country of origin, have not been successful. Collection information with the type description is: *In foliis vivis Carthami tinctorii L. Turcia. Ankara, 5.VI.1942. (Herb.*

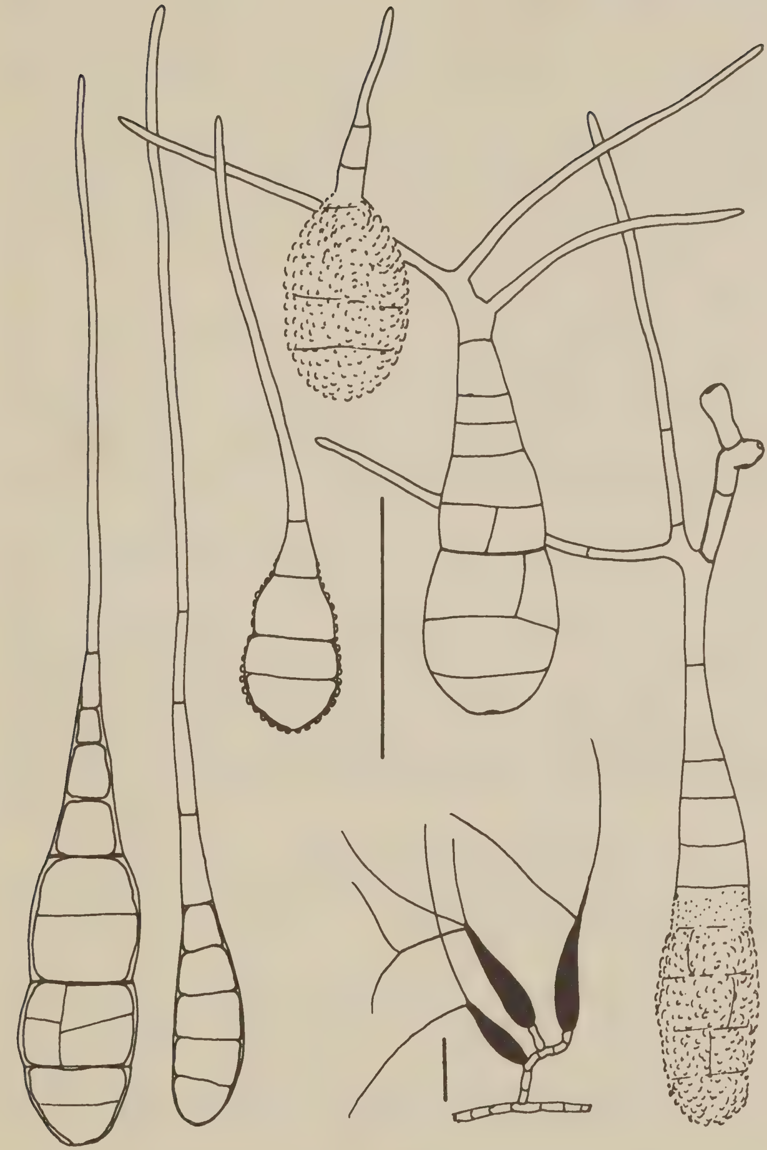

Fig. 140. *Alternaria carthami*: conidia and conidiophores ex representative isolate (EGS 31-037), ex PCA. Bars = 50μm.

Phytopath. Turcicum Ankara).

A fungus described and illustrated by A. Săvulescu from leafspots of *Carthamus tinctorius* had been submitted to her as a collection made in Turkey with a tentative identification "*Alternaria cichorii* Nattrass." She convincingly maintained that the dimensions of the narrow-beaked conidia of this specimen on safflower (a maximum overall length of ca. 195μm, a common size of ca. 120 x 20μm) were markedly different from those of *A. cichorii* (spore body 60-130 x 14-20 + beak up to ca. 280μm long), and that the fungus from Turkey simply had been misidentified.

Săvulescu was not at all convincing, however, in proposing the collection from Turkey as type of a species, *M. anatolicum*, different from *M. carthami* T. Săvulescu (i.e., *A. carthami* Chowd.). As basis for such a decision she relied on a spurious comparison of the full-length conidia of *M. carthami* (body + beak, up to 119μm) with conidium body length alone of *M. anatolicum* (up to 95μm).

Reconsideration of the *M. anatolicum* type measurements and conidium illustration in parallel with those of *M. carthami* reveals their close similarity: *M. anatolicum* conidia were presented as mostly up to ca. 150μm long overall (120μm long in her illustration); *M. carthami* conidia were presented as up to 90(-115)μm overall, with my own observation of largest type conidia giving a length of 145μm. Also, the type illustrations of *M. anatolicum* conidia are similar to those published for *M. carthami*, not only in size and beaks of conidia but especially in the carefully drawn distoseptation characteristic of the field types of the species.

I conclude that the two names in *Macrosporium*, *M. carthami* T. Săvul. and *M. anatolicum* A. Săvul. refer to the same species of *Alternaria*, for which *Alternaria carthami* Chowdhury is the correct name.

204. **Alternaria carthami** (Rodigin) Chowdhury, ex Nelen and Vasiljeva (1959), Bull. Centr. Bot. Gard., Moscow, 35: 83.

"*Alternaria carthami* (Radigin [sic]) Chowd. Syn. *Macrosporium carthami* Radigin. (Radigin, 1939)."

This quoted attempt by Nelen and Vasiljeva to regularize the author attribution of two presumed synonymous names for one or two leafspot fungi on safflower is nomenclaturally unacceptable. *M. carthami* Rodigin (*Alt.T&V*

200 above), whatever the identity of the species the name represents, would become a later homonym, and therefore illegitimate, on transfer to *Alternaria* at any time after the 1944 publication of *A. carthami* Chowdhury.

Discovery of Rodigin's type specimen could yield information on its identity, but the epithet of the name *M. carthami* Rodigin, like that of *M. carthami* T. Săvulescu, cannot survive a homonymic transfer to *Alternaria* under ICBN rules (ICBN Art. 53.1; Greuter et al., 1994).

205. **Alternaria neergaardii** B. S. Mehrotra & Narain (1969), Bull. Indian Phytopath. Soc. 5: 6. Pl. III-IV.

Lectotype: the authors' Pl. III-IV published with the type description (ICBN Art. 8.3, 9.9; Greuter et al., 1994).

The type was reported to be: "*AL 16 culture, isolated from Amberboa ramosa (Roxb.) Jafri [Syn. Volutarella ramosa (Roxb.) Santapau] and herbarium No.* ***HAL*** *16* [presumed to be a dried culture], *deposited in BSM Culture Collection, Botany Department, University of Allahabad, Allahabad.*"

The authors undertook that "A culture of the new species will also be deposited at Centraalbureau voor Schimmelcultures, Baarn, Holland, and at Commonwealth Mycological Institute, Kew." There is no listing of this species name in the catalogues of either **CBS** or **IMI**. I have been unsuccessful in obtaining information from **HAL** about the purported type material. Unless such material exists, we have recourse only to lectotypification of the published type illustration.

Mehrotra and Narain described conidia of *Alternaria neergaardii* as solitary, without secondary sporulation either in nature or in culture on Czapek's and malt agars. This character of single conidia with their long filiform beaks allows classification near *A. agerati* (*Alt.T&V* 211) and perhaps *A. zinniae* (*Alt.T&V* 210). It may be possible to recognize the species again on the basis of the rather extensive type description, drawings, and photographs of conidia from cultures. It cannot readily be identified with any other asteracicolous species treated here, so an abstract of type characters is inserted below for comparison purposes.

Conidia on the host were said to be solitary, smooth, pale brown, oval to cylindrical, constricted at septa, 57.2-82.0 x 17.8-32.0μm, with 4-12 transverse and 2-12 longitudinal septa, extending abruptly into a long, unbranched, filiform, hyaline beak 39.2-160.4 x 3.5-7.0µm, with 0-3 cross septa.

Conidia in culture were reported to remain solitary and have dimensions of 46-100 x 14-50µm (av. ca. 70 x 25µm), 4-13 transverse and 2-16 longitudinal septa, extending abruptly into a long filiform beak 28-356 x 3.5-7.0µm.

Particular attention was paid, in both description and illustrations, to the pronounced irregularity of conidium shape (usually as lateral swelling of cells) and to the successive production of swollen, somewhat thick-walled cells in many of the filiform beaks. Both the irregularly swollen conidium cells and the beak chlamydospores suggest, in my experience, that the ex-type isolate probably was culturally unstable and probably parasitized. This in turn suggests that the conidium widths (up to 50µm), the beak lengths (up to 356µm), and beak widths (up to 7.0µm in an otherwise narrower, filiform structure) were overstated and underqualified in presentation.

206. **Alternaria readeri** (Winter) Neergaard (1945), Danish Species of *Alternaria* and *Stemphylium*, p. 241.
Fig. 141

Holotype [**VPRI** 2714a]: *Herbarium F. Reader; Pleospora herbarum, Pers. & Macrospora* [sic] *Readeri, Winter; Loc. on dry stems of Cynara Scolymus, L. near Coburg* [Victoria, Australia]; *Date 10/8. 1885; Coll. F. Reader*; (EGS 44-027). I have been unable to locate a part of the specimen examined by Winter. If it exists separately from the holotype, it is designated isotype of the name.

≡ *Macrosporium readeri* Winter (1886), Revue Mycol. 8: 212.
≡ *Alternaria readeri* (Winter) Joly (1964), Encycl. Mycol. 33: 213.

A new combination in *Alternaria* has been published twice for this epithet: *A. readeri* (Winter) Neergaard (1945) and *A. readeri* (Winter) Joly (1964). Neergaard (l.c., p. 245) wrote that he had "not had occasion to study *Macrosporium readeri*" and Joly gave no indication of having studied either the type or modern collections of the species.

Winter described a fungus with very long, rigid, distinctly flexuous and torulose, densely septate, erect hyphae (presumably conidiophores) 300-320 x 9-10.5µm; and with clavate spores 10-14 transversely and 2 or more

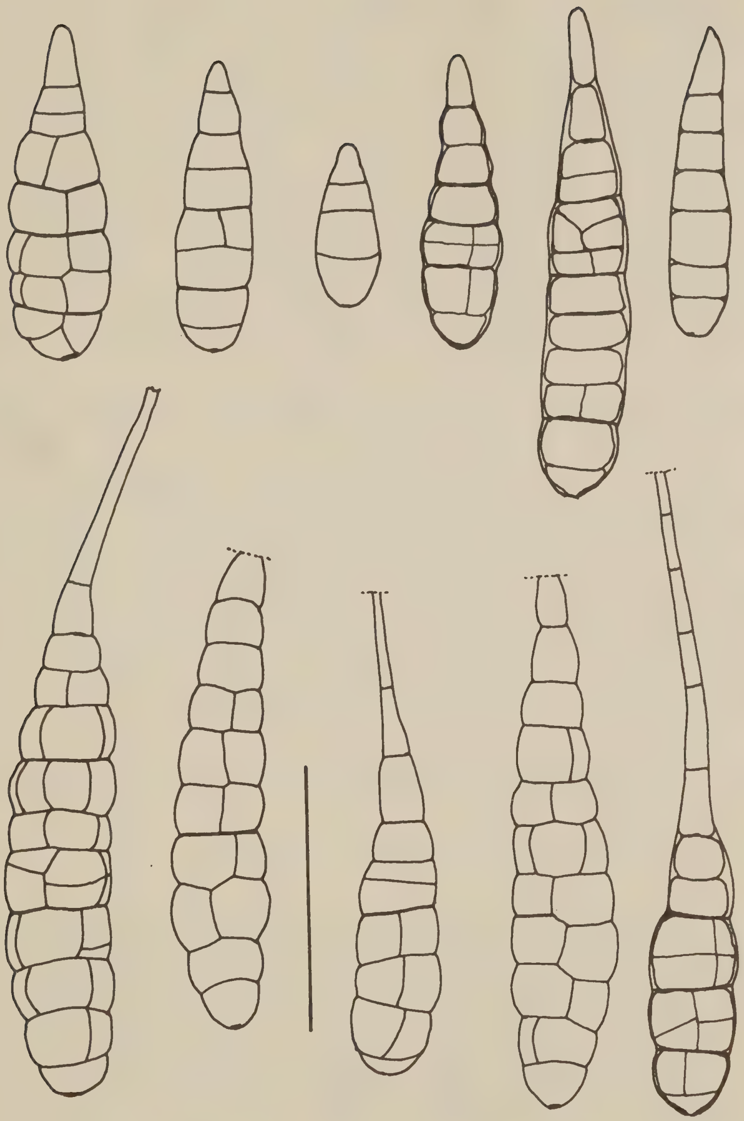

Fig. 141. *Alternaria readeri*: conidia ex holotype (EGS 44-027). Bar = 50μm.

longitudinally septate, 110-140 x 19-20μm, attenuated apically into a pale filiform-cylindrical beak.

Alternaria conidia seen in reexamination of the type are present in all stages of development and match Winter's description well, except that the fragile beaks on all mature conidia I have seen are damaged. Spore bodies reach a high range of ca. 60-100 x 15-20μm and extend into a narrow beak that may be at least 70μm long plus whatever fractured tip is missing. Conidia of the type often have reached mature size and septation before the distinct filiform beak developed. No evidence of secondary conidium production is apparent, but the absence of beak tips renders the point moot until the taxon is collected and recognized again.

207. **Alternaria scorzonerae** (Aderhold) Loerakker (1984), Netherl. J. Plant Path. 90: 37. Fig. 142

Lectotype: Aderhold, l.c. 1903, illustration : "*Auf der Blättern und Stengeln von kultivierte Scorzonera hispanica. Proskau, Aug. 1901. Münster i. W., Herbst 1902.*" I have not been able to locate authentic Aderhold material of this species, and Loerakker did not mention having seen such. A formal lectotypification is made, as indicated, in the belief that the Aderhold type is lost (ICBN Art. 8.3, 9.9; Greuter et al., 1994). I believe that Loerakker's material in fact represents the same species as that described and illustrated by Aderhold.

≡ *Sporidesmium scorzonerae* Aderhold (1903), Arb. biol. Abt. für Land. und Forst. 3: 440; 1 fig. un-no.

≟ *Macrosporium tau-saghyzianum* Zerova (1933); cfr. *Alt.T&V* 208 below.

Sporidesmium scorzonerae was the second relatively large-spored asteracicolous species to have been described that definitely is an *Alternaria*. (*Macrosporium readeri* on artichoke was the first; see *Alt.T&V* 206.) Aderhold's description of narrow-obclavate conidia 10-12 transversely and 1-2 longitudinally septate with spore bodies 50-75 x 13.5-16.5μm tapering into a long filamentous beak up to 185μm long matches the unnumbered illustration in his paper.

Comparable observations of Loerakker are of 8-14 transverse and 1-6 longitudinal septa in conidia 175-195 x 16-22μm (the length including a beak up to 120μm long). Loerakker's isolate is the only representative of this species known to be available (EGS 38-011).

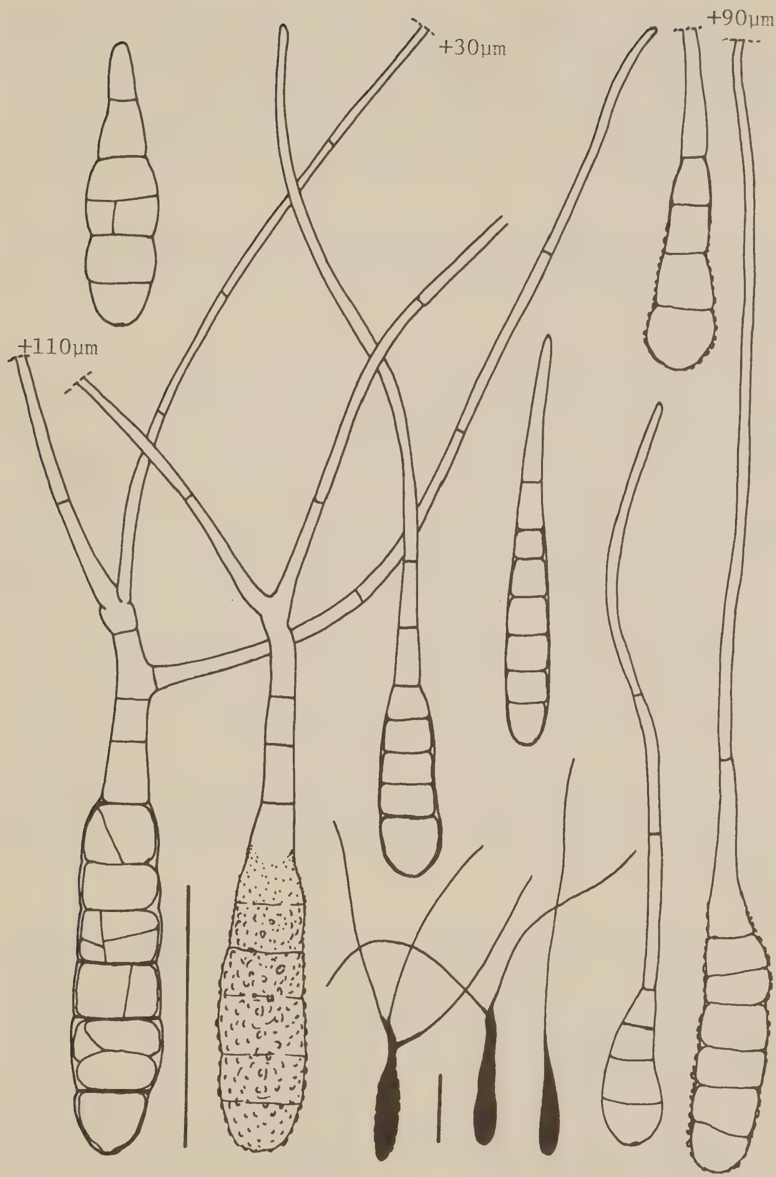

Fig. 142. *Alternaria scorzonerae*: conidia ex representative isolate (EGS 38-011), ex PCA. Bars = 50μm.

Colonies develop readily and sporulate abundantly on both PCA and V-8 agars. Conidia produced on PCA are solitary and almost always are borne on conidiogenous branches of aerial hyphae rather than at the agar surface. Conidia on V-8 also usually are solitary on aerial branches; chains of two conidia are rare, and small clumps of conidia occasionally occur when a primary conidiophore proliferates.

As a basic description from 7d. PCA cultures, conidiophores commonly have a size range of 50-110 x 5-7μm, with the narrow dimension at the base and a gradual but perceptible widening in the upper ca. one-fourth of the structure.

Juvenile conidia are ovoid to narrowly obclavate and can initiate production of long filiform beaks while still only 1-2 celled, or later after as many as 8-10 cells have been defined in the spore body. Conidium bodies reach dimensions up to ca. 70-100 x 15-20μm, have 7-11 transverse distosepta, through which a very few or no eusepta are produced, and 0-4 longitudinal distosepta, which seldom become euseptate in 7-10d. PCA colonies. Each conidium body may produce a solitary apical, filiform beak up to 200-250μm long, which tapers from a 4.0μm diam. base to ca. 2.5μm through most of its length. Much more commonly a pair of beaks up to ca. 150-175μm long or, frequently, 3 (rarely 4) beaks in the 150-170μm length range are produced. Conidia are a medium yellow-tan and practically always are ornamented, from fine punctulations to conspicuous tubercles.

My observations of conidium morphology are similar to those of Loerakker with a few exceptions, which are understandable, perhaps, because we used different culture media: Loerakker, 4% malt extract agar; Simmons, PCA and V-8 juice agars.

Examples of differing observations include those on the filiform beaks, which under my standard conditions commonly exceed 200μm in length, with even juvenile conidia often flaunting whiplash beaks 175μm long before a first longitudinal septum is formed. Loerakker gives "(-172.5)" as an exceptional maximum for mature conidia.

An additional observation is that the widths of well-developed conidia in my cultures are so commonly 18-20μm, as are those in Loerakker's illustration, that I wonder if Loerakker's notation of 7.2-10μm for in vitro conidia may be an editing oversight.

Additionally, Loerakker's characterization of the conidia as being "smooth but often covered with exudate droplets" is puzzling. Working with the same isolate, I am at a loss if I cannot describe the rather striking surface ornamentation as sometimes lacking but usually minutely rough over basal cells of young conidia, becoming conspicuously and coarsely tuberculate over about the lower half of largest conidia as the upper half remains essentially smooth.

208. **Macrosporium tau-saghyzianum** Zerova (1933), Zhurn. Biobotan. Tsiklu VUAN (Journ. Cycle Botan. Acad. Sci. Ukraine S.S.R.), Ann. II, no. 7-8: 156. Fig. 3.

Lectotype: the author's Fig. 3 published with the type description (l.c., p. 156) (ICBN Art. 8.3, 9.9; Greuter et al., 1994). No individual type collection was indicated; no Zerova specimen has been found. The type description cites material from Kiev: *In foliis vivis Scorzonerae tau-saghyz Lipsch. et Bosse in mense Augusto.*

The lectotype illustration is of solitary long-beaked conidia, which are described as 138.8-336 x 11.8-19.8μm with 8-13(-14) transverse and 1-6(-7) longitudinal septa.

Loerakker (1984) considered *Sporidesmium scorzonerae* and *Macrosporium tau-saghyzianum*, both on species of *Scorzonera*, to be the same species, and synonymized them in his treatment of *Alternaria scorzonerae* (*Alt.T&V* 207 above). Field conidium lengths given by Zerova are much greater than those given by Aderhold and by Loerakker. The overall morphology of *M. tau-saghyzianum* conidia (shape, septation, rostration) is similar to that of *A. scorzonerae*, but a satisfactory identification of the Zerova fungus is impossible without authentic material.

209. **Alternaria zinniae** Pape (1942), Angew. Bot. 24:69. Fig. 5.

Lectotype: the author's illustration "*Abb. 5*" (l.c., p. 67) published with the type description (ICBN Art. 8.3, 9.9; Greuter et al., 1994). Pape did not provide a Latin description; his name therefore was not published validly (ICBN Art. 36.1; Greuter et al., 1994).

It is noteworthy that Pape's 19-pp. study of *Alternaria zinniae* was detailed and admirable. Although he did not designate a type specimen, fresh material received from him (coll. Sept. 1956 at Kiel on leaves of *Zinnia elegans*) and isolates derived from it (EGS 10-016) are the same as the species described under the validly published *A. zinniae* M. B. Ellis (1972), for which see *Alt.T&V* 210 below.

210. **Alternaria zinniae** M. B. Ellis (1972), Mycol. Papers 131: 22. Fig. 143

Holotype [IMI 1037]: *Host Zinnia elegans, Ithaca, N.Y., U.S.A., A. W. Dimock, Sept. 28, 1942*; with IMI note *"Dimock intended this as Type of a sp. nov.; he withdrew (Oct. 1942) the species from publication on learning of A. zinniae Pape."*; (EGS 24-180).

Considerable attention was given to *A. zinniae* in *Alt.T&V* 7 (Simmons 1982) in order to differentiate it from *A. tagetica* Shome & Mustafee (1966). That comparison introduced the significant problems faced in using the literature on asteracicolous species of *Alternaria* with simple, filament-beaked conidia, of which those known are discussed herein.

Alternaria zinniae, as a frequently encountered parasite of horticultural *Zinnia elegans* Jacq., is understood and fairly readily identifiable on the basis of descriptions and illustrations published by Pape (1942), Neergaard (1945), and M. B. Ellis (1972). Classification problems and doubts arise, however, when these and other authors report the species as occurring naturally on representatives of other host genera, mostly but not exclusively of Asteraceae.

The host range cited by Joly (1964) appears to be literature-derived and therefore difficult, perhaps impossible to check. The Neergaard (1945) list also is impossible to review, as the sources were seed sample tests, for the most part without voucher specimens. The genus host range given by Ellis (1972, 1976), however, is based on specimens in IMI that can be correlated with his *A. zinniae* determinations.

Review of pertinent IMI specimens suggests that Ellis practiced a species-group concept for his *A. zinniae* identifications of filament-beaked species on Asteraceae. Examples, all listed by host genus as *A. zinniae* (Ellis, l.c.), include not only numerous specimens on *Zinnia elegans* Jacq. but also IMI 117116 = *A. calendulae* Ondřej on *Calendula officinalis* L. (EGS 24-154); IMI 115354(b) = *A. protenta* Simmons, on *Helianthus annuus* L. (EGS 24-160); IMI 76384(b) and IMI 88709 = *A. tagetica* on *Tagetes* sp. (EGS 24-163 and 24-164).

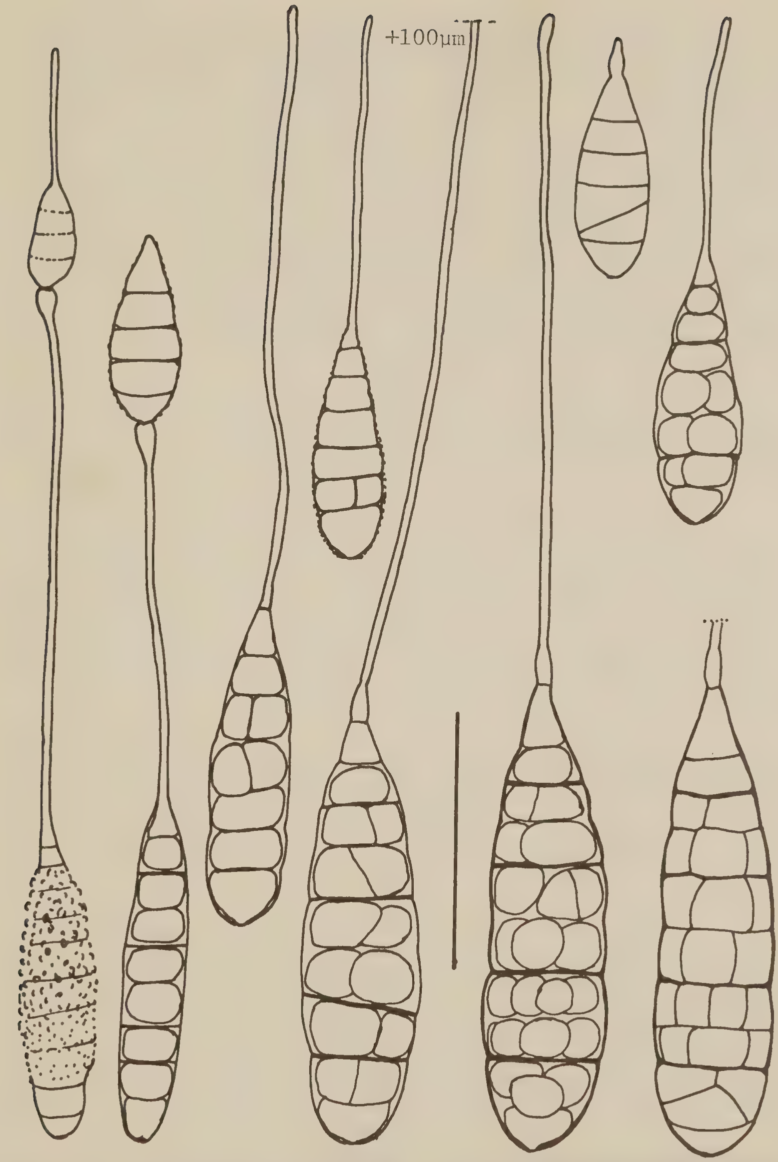

Fig. 143. *Alternaria zinniae*: conidia ex representative isolate (EGS 40-077), ex PCA; 2 units at lower right are the same conidium, one for relationship of distosepta to eusepta, the other all septa showing in surface view. Bar = 50μm.

A few specimens and an isolate of a filament-beaked *Alternaria* from a species of *Xanthium* L. (cocklebur) that originated in Australia have been available. On the basis of this material, I am unable at present to distinguish the *Alternaria* from *A. zinniae*. The evasive "at present" reflects the opinion that the *Xanthium* isolate can be distinguished microscopically from parallel ex-*Zinnia* cultures, but that the differences are mainly in density of conidium pigmentation and in dominant sizes of mature conidium bodies. The single ex-*Xanthium* isolate on hand (IMI 336377 (EGS 39-138)) is not culturally as stable as some of those from *Zinnia*; hence the equivocal "at present" until additional *Xanthium* isolates are available.

Sporulation and conidium characters of *A. zinniae* in culture are detailed in *Alt.T&V* 7 (Simmons 1982). That earlier treatment does not require repeating here, but a few characters can be emphasized and clarified.

Fully developed conidia of *A. zinniae*, both on field lesions and in axenic culture, typically are solitary with a long filiform beak. Very frequently, however, the tip of the beak of primary conidia expands slightly into a 1-cell secondary conidiophore and produces a relatively small secondary conidium ca. 18-32 x 10-14μm with a short filiform beak. The primary beak may be short (50-75μm) or quite long (200+μm) when its tip becomes conidiogenous.

Dimensions of the spore body of *A. zinniae* conidia produced in culture reach a high range of 70-80(-100) x 24-27μm; the solitary beak commonly is ca. 100-200(-300) x 1.5-2.0μm. Internal wall structure initially is distoseptate, and it remains conspicuously so to a great extent throughout conidium development.

In the earlier treatment (*Alt.T&V* 7; Simmons 1982, p. 21, fig. 10) mature conidia were drawn as though they were completely euseptate, which can be misleading as this seldom is true in 7-10 d. cultures. The 8-10 major transverse septa of mature conidia may become euseptate, as may a few of the short longitudinal septa. However, many secondary septa, both transverse and longitudinal, and sometimes all septa in some full-size conidia, remain in the distoseptate condition. In the figure cited, some young conidia drawn in optical section illustrate the internal pattern of distoseptum and euseptum development. The largest conidium in the figure, however, gives a surface-view interpretation of the septation pattern, without distinguishing eusepta from distosepta except in the case of the major eutransepta.

An additional illustration is included here (Fig. 143) to emphasize the primarily distoseptate condition of *A. zinniae* conidia as they develop in 10d. PCA cultures.

As the type description in Ellis (1972, repeated in 1976) is used widely as a guide to identification of *A. zinniae* and similar taxa, it should be noted that his spore body measurements "55-105(75)" indicate a maximum length of 105μm and an average or mean length of 75μm. Re-examination of the type shows that a reading such as "55-75(-85)" gives a more useful, perhaps more accurate picture, for I have been unable to find any larger spores in samples from the excellent and abundant type material. Ellis's type illustration shows no conidium body longer than 75μm. Granting the possibility that a length of 105μm may be present (ca. 30% greater than hundreds of mature conidia in the type), citing it as anything other than truly exceptional distorts the characterization of *A. zinniae* and misleads the unwary on this and other somewhat similar taxa.

211. **Alternaria agerati** K. Sawada ex E. Simmons, sp. nov.
Fig. 144

This is intentional validation of a name introduced by Sawada in 1943 with a description in Japanese but without the required Latin, therefore invalid (ICBN Art. 36.1; Greuter et al., 1994). Nomenclatural priority of the name dates from the present publication, not from Sawada's 1943. The validating Latin description below is a fairly close translation of the original Japanese, without interpolation of data from later specimens.

["*Alternaria Agerati* Sawada sp. nov." Report Agr. Res. Inst. Formosa no. 86. 1943. p. 165.]

Maculae foliicolae, circulares, ad centrum luteo-brunneae, ad marginem brunneae, margine indistincta, 2-7mm diam. Conidia solitaria vel raro catenulata, ampulliformibus, 4-11 transverse et 0-5 longitudine septata, ad transepta constricta, pallide brunneola, 30-162 x 8-20μm. Specimen lectum pro parasita foliorum Ageratum conyzoides L., Taihoku, 7 April 1919, Heishichi Sueda. Distributio Formosa.

Holotypus [**TAI**]: *Alternaria agerati Saw., on Ageratum conyzoides L., Taipei (Taihoku) Form./Apr. 7, '19, H. Sueda* [ms. label modern?]; (EGS 12-102).

The following description is based on cultures of an isolate received in 1971 as "from *Ageratum houstonianum* Mill.

in a commercial greenhouse; Springfield, Illinois; November 1968; J. L. Forsberg; ILLS 34926" (ref. Forsberg and Crane, 1970); (EGS 30-001, QM 9369).

Conidiophore and conidium production of *A. agerati* on PCA is abundant, but somewhat open-spaced rather than crowded. Sporulation on V-8 is very abundant and crowded, particularly in the areas of dark concentric rings that represent a response to light during light/dark cycles. Conidia are solitary for the most part, seldom in chains of two spores. Conidiophores usually remain simple; however, some may produce short lateral conidiogenous branches as they lengthen, while others develop in small clumps with a common base at the agar surface or extend apically as a series of short geniculations. The resultant 50X aspect is of a stand of simple conidiophores with an intermixture of clumped or aerially tufted units or groups of conidiophores and their conidia.

Simple conidiophores are relatively sturdy, initially reaching ca. 125-145 x 6.5μm before the few lateral sporogenous branches or apical geniculations are formed. Juvenile conidia (3-4 distoseptate) are narrow-ovoid, ca. 30-55 x 7-10μm, with a bluntly conical apical cell. These develop readily into broader, long-ovoid beakless conidia ca. 60-70 x 15-17μm, which usually initiate production of an apical filiform beak at this stage or a little earlier. Large numbers, a strong preponderance, of conidia mature at ca. 160-200 x 21-26μm (body ca. 80-100 + beak 80-110 x 1.5μm).

The mature conidium body of *A. agerati* is essentially ellipsoid with greatest width median; in some instances body shape is long ovoid or even long obovoid, with greatest width sub- or supra-median respectively. Usually the basal cell is about as long as wide; occasionally it is noticeably longer than wide, though not so drastically so as is found typically in *A. blumeae* (*Alt.T&V* 222). Mature conidia commonly have 8-9 transverse distosepta, through 3-4 of which constricting eusepta are formed. The few longitudinal distosepta remain without euseptum insertion during an initial week of observation in culture. Conidium color is a dull, medium yellow-brown; wall ornamentation is punctulate from the early juvenile stage through to conidium maturity.

Alternaria agerati and *A. blumeae* are similar in some cultural and microscopic characters. See *A. blumeae* (*Alt.T&V* 222) for comments on differences between the two species.

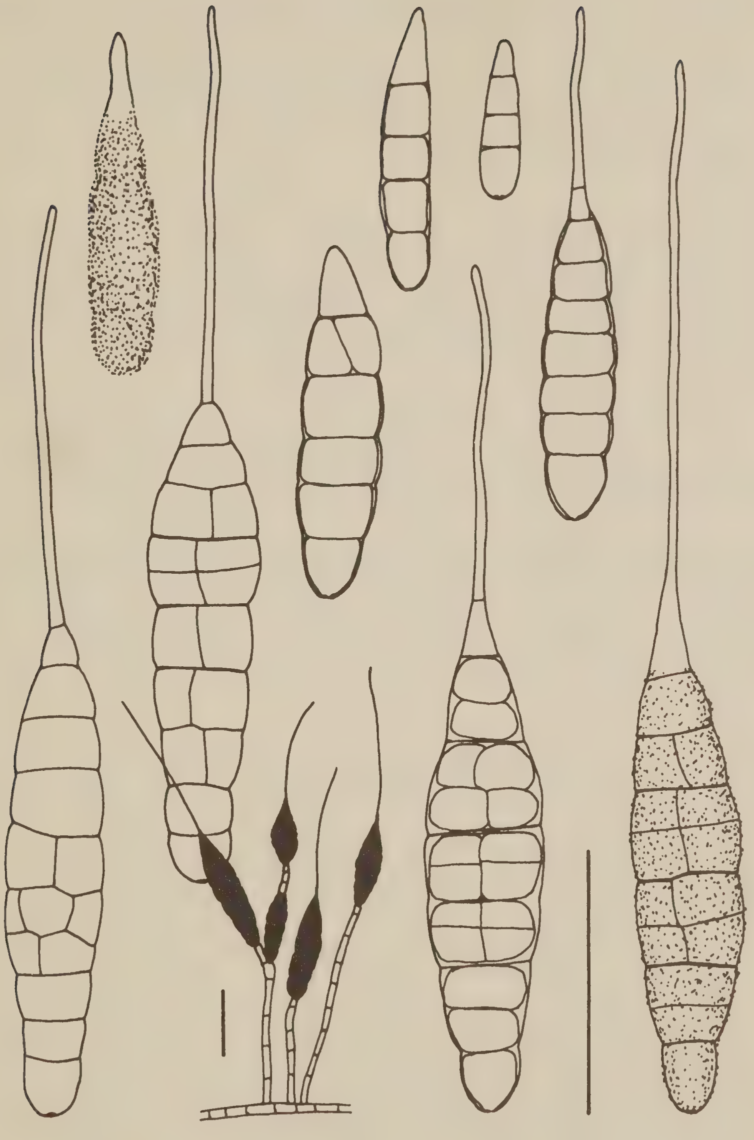

Fig. 144. *Alternaria agerati*: conidia and conidiophores ex representative isolate (EGS 30-001), ex PCA. Bars = 50μm.

212-216. Names in **Macrosporium** and **Alternaria** for species described from *Calendula officinalis* L.

Names for species of *Macrosporium/Alternaria* on *Calendula officinalis* L. exist in several different formats and author attributions. Each is discussed below in chronological order of publication.

212. **Alternaria** sp.: S. Yamamoto (1934) described and illustrated an *Alternaria* species with large, filament-beaked conidia on *Calendula officinalis* L. He did not name the species. [Ref. in transl.]: Two new diseases, an *Alternaria* spot of *Calendula officinalis* L. var. *subspathulata* and a bacterial leaf spot of *Lactuca sativa* L. var. *angustata*. Byōchū-gai Zasshi [Journ. Pl. Protect.] 21: 528-533. 1934.

Conidium dimensions in Yamamoto's illustrations are 110-145 (incl. beak) x 15-20μm, with 7-11 transverse septa and 1 longitudinal septum in 1-4 of the transverse segments.

An attribution "*Alternaria calendulae* Yamamoto" appears in several Japanese publications, but I can find no evidence that the name ever was proposed by anyone as a new species, with or without reference to Yamamoto's unnamed *Alternaria*. The attributed binomial is a nomen nudum and without nomenclatural standing wherever it has been used, e.g., in Fujioka (1952, p. 87); K. Hara (1954, p. 12); W. Yamamoto (1960, p. 91).

213. **Macrosporium calendulae** Nelen, ex Nelen and Vasiljeva (1959), Bull. Centr. Bot. Gard., Moscow, 35:90.

[Transl.]: *On leaves of Calendula officinalis 27.VII 1955 and 20.VIII 1956*. A Latin description was not provided. The name was not published validly in 1959.

214. **Macrosporium calendulae** Nelen (1962), Botan. Mater. 15: 144. Fig. 2.

Holotype [**LE**]: *Macrosporium calendulae Nelen sp. nova, on Calendula officinalis*, [translit.]: *Dalnii Vostok, Primorskii Krai, Vladivostok, St. Okeanskaya, D. V. Bot. Sad.* [Far East, Primorski Krai [Maritime Terr.], Vladivostok, Okeanskaya Station, Far East Botanical Garden], *Anno **19 21** viii **56*** [21 Aug. 1956], *Leg./Det. Nelen, E. S.*; (EGS 20-167).

The species description included Latin description, illustrations of conidia from field and culture, type (holotype) citation, and depository of type. The name was published validly and predates other names published for the species. However, transfer of the name *M. calendulae* Nelen (1962) to *Alternaria* as "*Alternaria calendulae* (Nelen)..." cannot be maintained under ICBN rules on later homonyms (ICBN Art. 53.1; Greuter et al., 1994). See *Alt.T&V* 215, below.

215. **Alternaria calendulae** Ondřej (1974), Časopis Slezského Muzea A, 23: 150. Fig. 145

Holotype [**BRA**]: *Flora Moravica, Alternaria calendulae/Elenkin* [A. Elenkin, Russian botanist; host identifier?]; *Matrix: Calendula officinalis L.; Loc.: Libina, hřbitov (okr. Šumperk)* [Libina, cemetery, Šumperk County, Moravia]; *Dat. 22.8.1970; Leg.: Ondřej M.*; (EGS 44-039).

The name meets all requirements of valid publication. In addition, the holotype specimen is excellent.

Zonate leafspots in the Ondřej collection bear abundant conidia in all stages of development. Long elliptical to obclavate conidia typically are furnished with a long narrow beak, which usually begins lengthening when the spore body itself still has only a few transverse distosepta. Ondřej gave conidium length measurements of 60-140μm (body) plus 20-110μm (beak), totalling (80-)120-250 x 10-20(-22)μm, which compares well with my measurements of up to ca. 240 x 20μm from his type.

All published descriptions of *A. calendulae* reported relatively large conidia with spore bodies in ranges of 80-200 x 16-24μm (Nelen), 60-140 x 10-22μm (Ondřej), and 60-141 x 15-42μm (Nirenberg; see *Alt.T&V* 216, below). Conidium beak lengths were given by the several authors as in an additional maximum range of 110-200μm. Both Nelen (1962) and Nirenberg (1977) noted and illustrated the occasional occurrence of a branching beak in culture. I have seen multiple beaks in conidia of only one *Calendula* field specimen (Nattrass, Cyprus, **IMI** 997 (EGS 24-081)). However, they occur frequently in cultures of an isolate from Japan, which is used as the basis for the following description (EGS 30-142).

Colonies of *A. calendulae* develop on PCA as sparse, radiating, branching hyphae on and within the agar substrate. In spite of such a meager mycelial base, the moderate and somewhat scattered sporulation is without obvious morphological aberration. Mycelium development on V-8 is much stronger than on PCA. It is almost wooly, with sporulation abundant and crowded, both on surface conidiophores and on those originating from most of the aerial hyphae.

Conidiophores on V-8 usually are simple, any length up to ca. 125-200(-300)μm, and either ca. 8μm wide throughout or gradually increasing in width from a narrow basal region ca. 4μm wide to an apical subclavate region ca. 8μm wide. Many conidiophores do not remain simple but develop a close series of short fertile branches or geniculations near the initial conidiophore tip. The 50X aspect thus is of very abundant solitary conidia, often in divergent series on close geniculations, interspersed with tight clumps of 2-5 conidia on the branching tip of a primary conidiophore.

Conidia produced in culture are solitary; production of 2-conidium chains may occur, but is rare. Juvenile conidia usually are narrowly ellipsoid; a small number initially are broad-ovoid. Beak formation begins when the conidium body has only 1-4 transepta. Enlargement of the conidium body and extension of the beak are concurrent. Conidium body size commonly reaches a range of 65-105 x 20-26μm, with 9-11 transepta and 1(-2) longisepta; the beak becomes 136-160μm long, tapering gradually from ca. 4μm at the base into a distal 2μm diam. The conidium body is medium yellow-tan without wall ornamentation. Internal division of the conidium body is distoseptate well into maturity, and remains so (in 10 d. cultures) except for the insertion of a brown euseptum through 2-6 of the transverse distoseptum regions. The conidium body usually is slightly constricted at each euseptum locus.

Although the primary filiform beak occasionally produces a single branch at some distance from the conidium body apex, it is much more characteristic for a second and, rarely, even a third beak to arise from the same apical cell that initiated the primary beak. Conidia with multiple beaks are infrequent in V-8 colonies but quite common on PCA.

The best representative isolate at hand, described above, was received in 1969 via T. Tominaga (National Institute of Agricultural Sciences, Tokyo, Japan) as A145 from *Calendula officinalis* (EGS 30-142; QM 9561)). Other representative specimens include the types of *Macrosporium calendulae* Nelen, *Alternaria calendulae* Ondřej, and *A. calendulae* Nirenberg, as well as collections by R. M. Nattrass at Nicosia, Cyprus, dtd 1938 (IMI 997, 998; EGS 24-080, 24-081); by R. H. Sciaroni, Palo Alto, California, dtd 1949 (EGS 05-144); by Khadga in Nepal, dtd 1965 (IMI 117116; EGS 24-154); and by N. Nishihara in Chiba, Japan, dtd 1970 (EGS 29-158). All are on species of *Calendula*. An isolate from *Artemisia dracunculus* L. (LEV 22306, Riverhead, Auckland, Jan. 1984; EGS 37-077) also appears to be typical of *A. calendulae*.

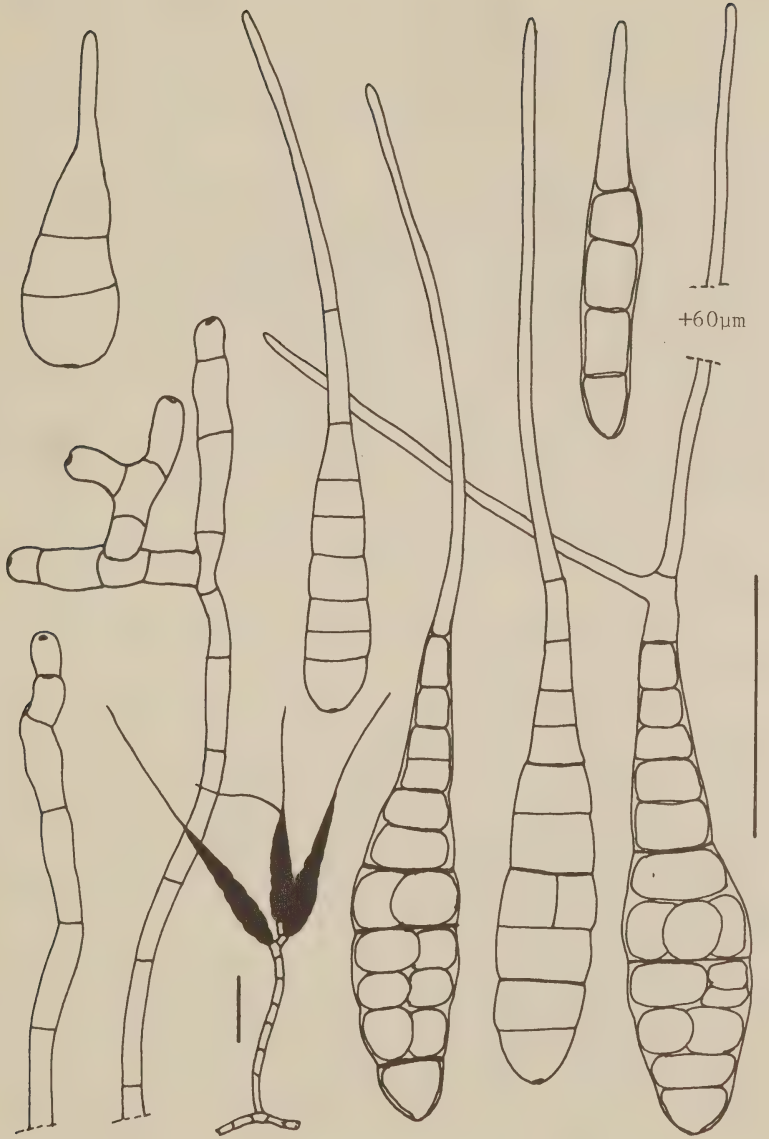

Fig. 145. *Alternaria calendulae*: conidia and conidiophores ex representative isolate (EGS 30-142), ex V-8. Bars = 50µm.

216. **Alternaria calendulae** Nirenberg (1977), Phytopath. Zeitschr. 88: 108.

Holotype [**IMI** 205077]: (dried culture) *ex Calendula officinalis, W. Berlin, Germany, coll. Helgard Nirenberg, 1975*; (EGS 33-103).

Nirenberg described her isolates as a new species from leaves of *Calendula officinalis*. Included were a Latin description, illustrations, type citation, and **IMI** as type depository. The name is a later homonym of *A. calendulae* Ondřej and therefore is to be rejected (ICBN Art. 45.4; Greuter et al., 1994), as Nirenberg did in a footnote to her paper when the 1974 Ondřej publication came to her attention. Nirenberg was aware of the publication of *Macrosporium calendulae* Nelen (Nelen and Vasiljeva, 1959) and correctly considered the name, absent a Latin description, to have been published invalidly at that date. She did not mention the subsequent valid publication of *M. calendulae* Nelen (1962).

217. **Alternaria protenta** Simmons (1986a), Mycotaxon 25: 207. Fig. 146

Holotype [**IMI** 115354b]: *K. Wilson, Mount Makulu, Chilanja, Northern Rhodesia, March 1963*; (EGS 24-160).

Alternaria protenta originally was described (*Alt.T&V* 18) on the basis of a dried field specimen on a stem of *Helianthus annuus* L. No living isolate was known at that time. Three excellent isolates subsequently have become available for study through the cooperation of J. C. David, International Mycological Institute, Egham, U.K. (EGS 45-023/-024/-027; **IMI** 372955/372957/372954, isolated from *Helianthus annuus*, Israel). Observations on their development in culture are added here to the record on this distinctive species.

Conidia of typical (field) *A. protenta* are remarkably stretched out or lengthened, as the epithet suggests. Mature long-ellipsoid spore bodies have a length/width ratio near 6.0-8.3. Actual dimensions are ca. 100-110 x 12-15μm plus a filiform beak ca. 125-150 x 2.0μm.

Dimensions of mature conidia produced on PCA (7d.) are ca. 80-104 x 17.5-20.8 plus a beak 96-136μm long that tapers from a 4μm base to 2μm tip; conidium body l/w ratios in culture are ca. 4.5-7.5. Here, and as a general observation for *Alternaria*, conidia maturing under culture conditions often are shorter and smaller overall than comparable ones

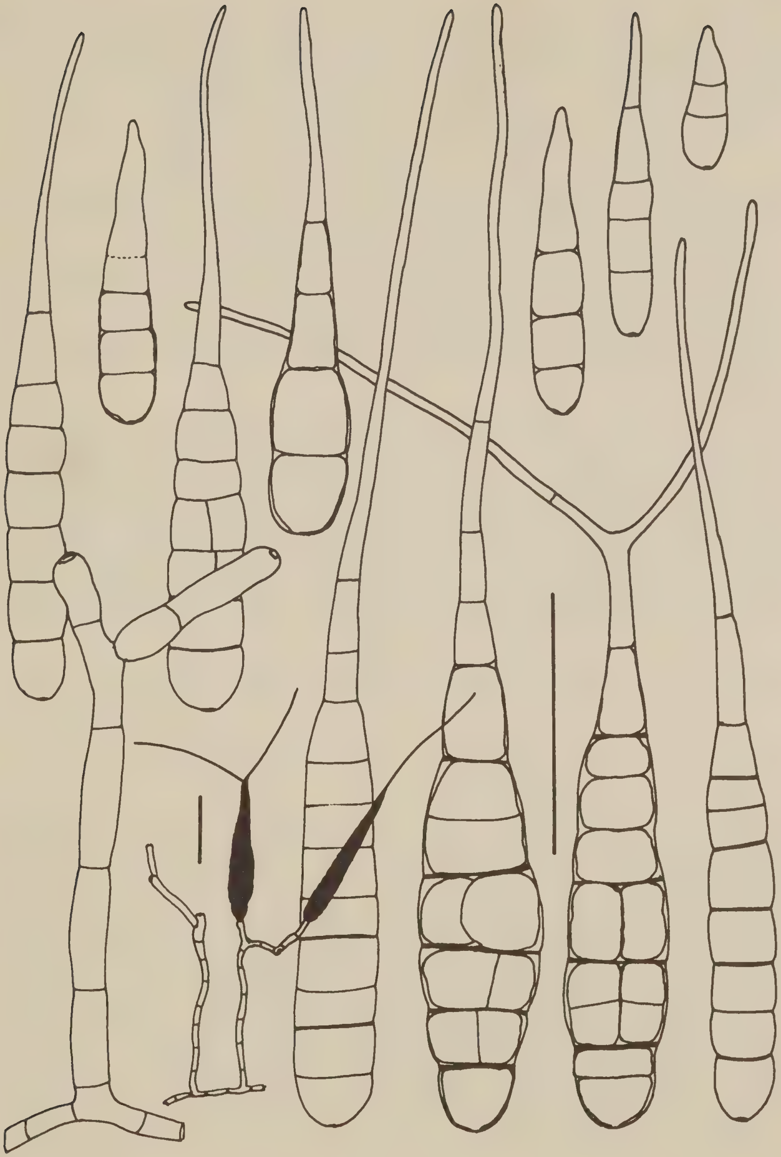

Fig. 146. *Alternaria protenta*: conidia and conidiophores ex representative isolate (EGS 45-027), ex PCA. Bars = 50μm.

(shape, septation) found in the field. Exceptions to such an observation surely are legion, but it can be an aid to identification to keep in mind this commonly observed difference in dimensions of conidia in culture and those of field spores that served as the source of isolates.

In the case of *A. protenta*, diagnostic long, slender conidia are abundant. Other characters that are parallel in field and culture are the tendency for conidiophores to elongate through several conidiogenous geniculations and branching, and for juvenile conidia to be beakless and apically bluntly conical before the filiform beak begins its growth. Primary conidiophores commonly are ca. 150-225 x 8µm before many/most of them initiate secondary growth and sporulation.

Conidia produced in culture may have smooth walls, or may show a variety of even punctulation. They rarely form in chains, but may do so through conversion of a primary beak to a secondary conidiophore. Evidence of multiple beaks was not seen in the field type, but pairs of filiform beaks can be found easily in slide preparations from culture. Both beaks appear always to originate in the same apical cell of the spore body, i.e., neither beak is a branch of the other.

218. **Alternaria cirsinoxia** Simmons & Mortensen, sp. nov.

Fig. 147, 148

Etym.: L., *Cirsium + noxia*, injurious to *Cirsium*.

Ex cultura in agaro V-8 descripta. Conidiophora simplicia, peranguste clavata, 80-150+ x 5-8µm; vel 2-5-geniculata et conidiogena, ad 200-250µm longa; vel 2-3 ramosa, conidiis in caespitibus. Conidia solitaria, raro 2 in catena, longiovoidea, dein obclavata, 1-3 rostris filiformibus. Corpus conidiorum 55-80(-100) x 19-23µm, dilute brunneum, ubique punctulatum vel conspicue punctatum, 5-7 transverse distoseptatum, dein partim euseptatum; rostrum conidiorum filiforme, ad 125-160 x 2-5µm ubi solitarium vel ad ca. 80-95µm longum ubi multiplex. Habitatio typi in Cirsium arvense L., Watrous, Saskatchewan, Canada. Holotypus: pars ex cultura EGS 41-136 (ex isol. K. Mortensen, August 1993) desiccata et in **BPI** *749416 conservata.*

Sporulation structures dominate cultures on PCA and V-8 agars, i.e., vegetative surface and aerial hyphae of the colonies support development of large but uncrowded numbers of conidiophores and their conidia.

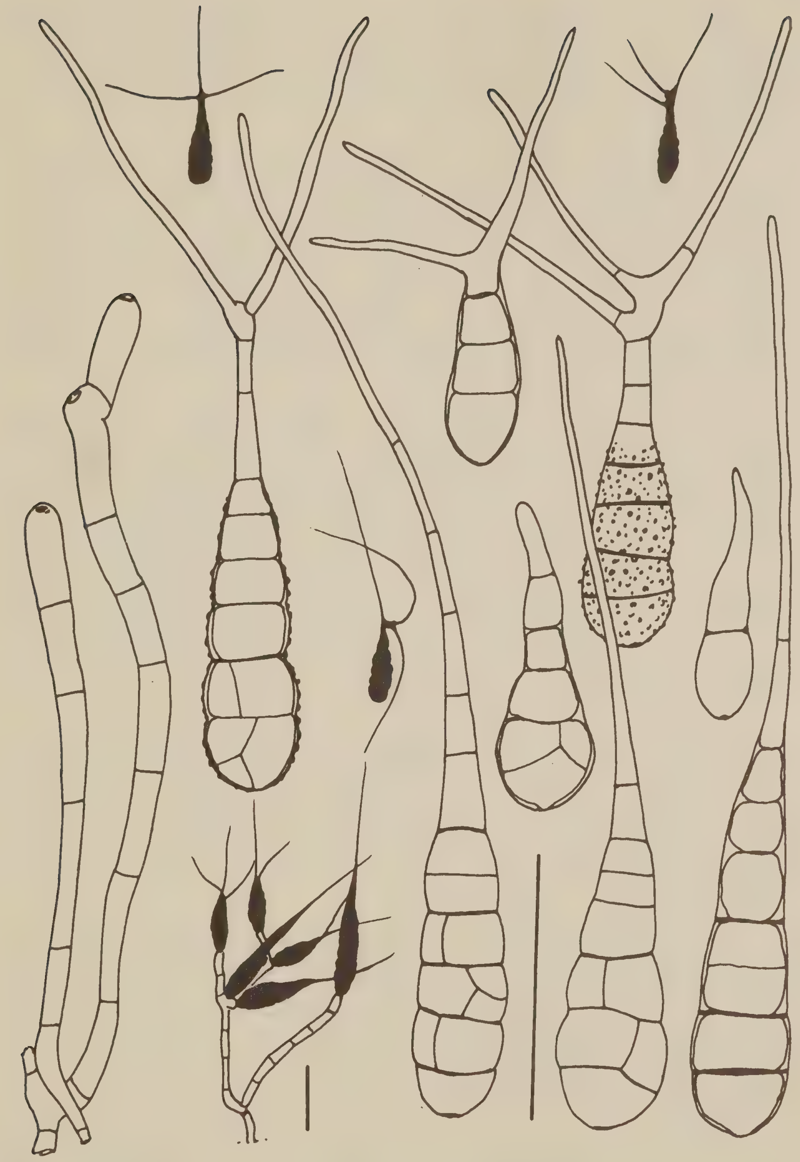

Fig. 147. *Alternaria cirsinoxia*: conidia and conidiophores ex-type isolate (EGS 41-136; Saskatchewan, Canada), ex V-8. Bars = 50μm.

Many conidiophores produce one terminal conidium and then develop no further, even in actively expanding colonies. However, the overall 50X aspect of 1-2 wk. cultures is of clumps of 2-5 strong, geniculate or branching conidiophores supporting tufts of 2-7 conidia.

Conidiophores tend to become wider as they lengthen, rather than remaining evenly cylindrical throughout. Narrow-clavate, simple conidiophores are straight or somewhat curved or sinuate, commonly 80-150+ x 5-8μm, medium dull brown but paler in narrower basal regions. Multigeniculate conidiophores (2-5 conidial sites) usually are longer, often up to 200-250μm. Branching near a conidiophore tip is of 2-3 arms, which themselves may be progressively geniculate, yielding tufts of several conidia.

Conidia nearly always are solitary; a chain of two conidia occasionally can be seen. Conidia initially are long ovoid, soon becoming obclavate with a basal region almost as wide as that of more mature conidia. Development of a beak extension begins very early, even when the juvenile conidium body is no longer than 30μm. Fully developed conidia are obclavate, usually tapering into a single long filiform beak. However, a high percentage of conidia produce two filiform beaks from the apex of the conidium body; and a very considerable number produce three terminal beaks, or two with one of them being branched.

The fully developed conidium body is 55-80(-100) x 19-23μm, medium dull brown, punctulate to conspicuously punctate overall, with 5-7 transverse distosepta. Eusepta may be laid down through a few or, rarely, all of the transverse distoseptate regions. Solitary filiform beaks become ca. 125-160 x 2.5μm; each unit or arm of a multiple beak system usually is shorter, ca. 80-95(-125)μm.

An isolate that I believe to represent this same species reached me in 1980 from D. J. Robeson, who had isolated it from a necrotic leaf lesion of Canada thistle (*Cirsium arvense*) collected in Montana (EGS 33-145). Having lost the strain from my own collection, I was fortunate to be able to retrieve it recently from IMI, where Robeson had deposited it also (IMI 257563; EGS 44-112).

The Montana strain has the same 50X appearance in culture as the Saskatchewan isolate, i.e., an uncrowded to dense population of simple conidiophores bearing a single conidium or, more commonly, closely branching and geniculate conidiophores bearing tufts of several conidia.

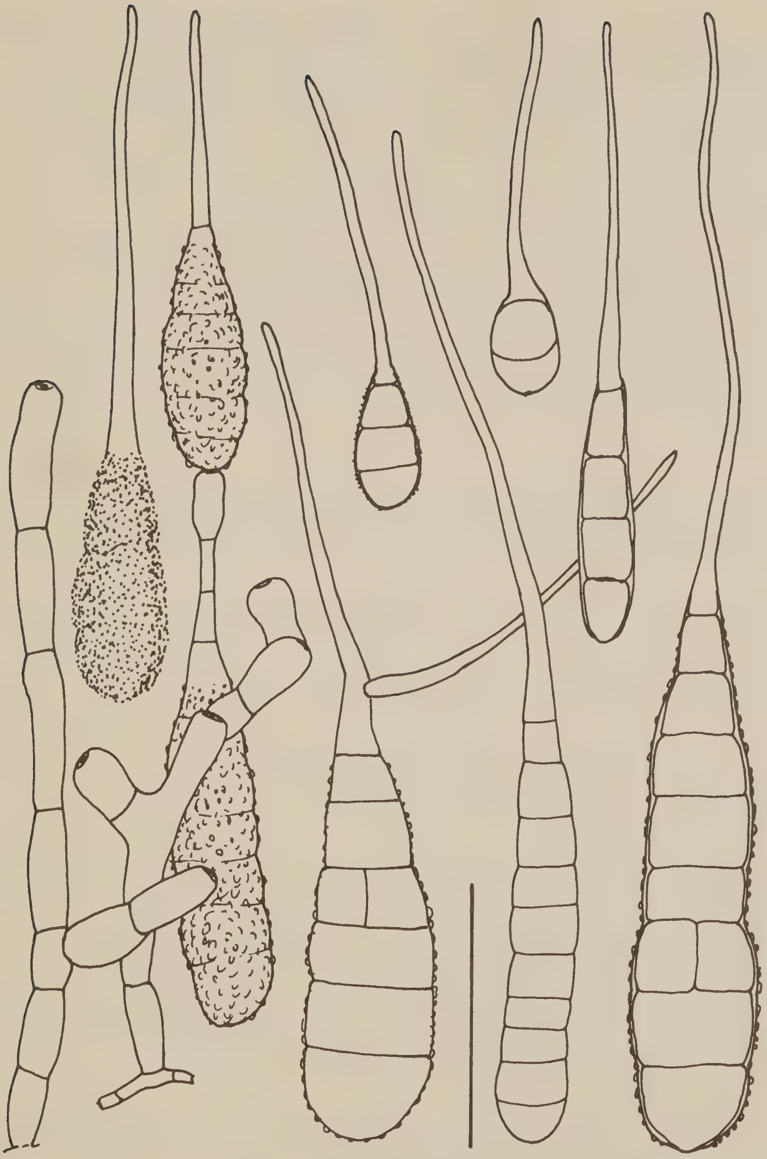

Fig. 148. *Alternaria cirsinoxia*: conidia and conidiophores ex representative isolate (EGS 34-052 = 44-112; Montana, U.S.A.), ex PCA. Bar = 50µm.

Conidium bodies are somewhat longer in the Montana isolate (Fig. 148), reaching an ordinary length of ca. 100-110μm before tapering into a simple filiform beak up to ca. 150μm long. These longer conidia with a single beak dominate the spore population to such an extent that the 195X picture is different from that of the Saskatchewan isolate (Fig. 147), large numbers of whose conidia are conspicuously 2(-3)-beaked and usually not longer than ca. 80μm.

However, when conidia of the Saskatchewan isolate have only a single beak, they have essentially the same dimensions as those of the Montana isolate. Beak proliferation in the Saskatchewan strain occurs before conidium bodies reach potential maximum length, thus yielding predominant conidium lengths somewhat shorter than those of the Montana isolate, in which 2-beak conidia are produced but not in conspicuous numbers.

Conidium walls of the Montana isolate become conspicuously punctate to strikingly tuberculate, in contrast to those of the usually less heavily ornamented spores of the Saskatchewan strain.

An R. M. Nattrass specimen on *Cirsium* in Cyprus has large conidia with a single beak: up to 150 + 112 (body + beak) x 32μm (EGS 24-084 ex IMI 996). Conidium walls are not ornamented and no evidence of multiple beaks is found in the slide preparation available to me. Conidia of the Cyprus field specimen are almost twice as large as conidia produced by the Saskatchewan isolate after inoculation (Mortensen) on surface sterilized leaves of *Cirsium arvense* (EGS 41-137). See below, *Alt.T&V* 223, *Alternaria nattrassii* sp. nov.

"*Macrosporium cirsicola* Nasyrov sp. nov." has been recorded for a collection from Turkmenistan. The listing is without specimen citation or description of any sort and therefore was published invalidly (ICBN 36.1; Greuter et al., 1994). It is entered here only for the intended complete coverage of *Macrosporium* names. The entire entry reads (in translation) *Macrosporium cirsicola Nasyrov sp. nov. On dry stems of Cirsium ochrolepideum Juz. Chardzhou, "Kishtivan" village soviet, 11 VI 1960.* (Nasyrov, 1965).

219. **Alternaria tagetica** Shome & Mustafee (1966), Current Science 35(14): 370; fig. 1.

Lectotype: the type was reported to be a specimen "*On plants of Tagetis* [sic] *sp., Floriculture Gardens, University of Kalyani, January 1965...in the Department of Plant Path-*

ology, University of Kalyani, India, Herb. No. A.F.P.P.H. 104." Neither type nor authentic material of the species has been available for examination. Assuming that the holotype is indeed lost, the type figure is selected here as lectotype of the name (ICBN Art. 8.3, 9.9; Greuter et al., 1994).

Isolates and a few field collections considered to represent this parasite of *Tagetes* sp. were discussed in detail in *Alt.T&V* 8 (Simmons, 1982), where emphasis was on differentiating this species from *A. zinniae* M. Ellis, with which it often has been misidentified. The observations and conclusions expressed in 1982 are supported strongly by additional isolates (EGS 44-044, 44-045) derived from diseased horticultural *Tagetes* sp. collected as M. A. Vincent #7454, Oxford, Ohio, 14 June 1996. There is no need to repeat the earlier detailed notes, but a few characters can be emphasized.

Conidia on field material and in the first flush of new sporulation on infected tissue held overnight in a damp chamber are almost entirely solitary with a long filiform beak. Measurements of well-matured conidia in the Vincent specimen are ca. 104-120 x 24-32 (body) + 120-225μm (beak, which tapers from a base ca. 8μm wide to a 3μm tip). These conidia have 8-10 major transverse septa and usually 1-2 longitudinal and occasional secondary transverse septa in some of the transverse segments. The beak itself has 4-5 transepta.

Sporulation in culture, in contrast to that of the field, is abundantly catenate on both PCA and V-8 agars. Cultures 7-10d. old contain numerous large conidia with long, unaltered filiform beaks. However, it is much more characteristic for the tip of a filiform beak to enlarge abruptly into a secondary conidiophore with a sporogenous site at its apex or often at each of 1-3 successive geniculate extensions. Even more commonly, sturdy secondary conidiophores develop directly from the apical cell of erostrate conidia of any size and stage of septum development. Both kinds of secondary conidiophores may be involved in the generation of chains of 2-5 conidia. Dimensions of conidium bodies in the same stage of maturity as those mentioned above for field material are ca. 88-120 x 22-32μm. Unaltered filiform beaks do not differ significantly from field counterparts. Primary conidiophores arising directly from the agar substrate are sporogenous at any size in the range of ca. 15-160 x 6.5μm; secondary conidiophores may be short, ca. 15-20μm, when produced at the tip of a filiform beak, or as large as 240 x 8μm when produced from the erostrate apex of a conidium. The filiform beak, if present, is solitary and does not branch, although occasionally it produces a short lateral secondary conidiophore in addition to one at its tip.

220. **Alternaria danida** Simmons, sp. nov. Fig. 149

Etym.: **DAN**ish **I**nternational **D**evelopment **A**gency, which was instrumental in supporting much of the late Paul Neergaard's activity with the Danish Government Institute of Seed Pathology for Developing Countries.

Ex cultura in agaro PCA descripta. Conidiophora simplicia vel saepe 1-2-ramosa, plerumque ad 80-150 x 7-8μm. Conidia solitaria (raro 2-catenata), juventute vulgo anguste elliptica vel longiovoidea, filiformiter rostrata; postea quasi cylindrica, 7-8 transverse septata, corpore ca. 70-80 x 13-17μm; maturitate late ellipsoidea, ad ca. 95-120 x 23-26μm, 6-11 transverse et 2-3 longiseptata, rostro filamentoso ad 175-250 x 3-4μm simplici vel plerumque uniramoso.

*Habitatio typi in semine Ageratum houstonianum Mill. Holotypus: pars ex cultura EGS 07-029 (**CBS** 111.44, isol. P. Neergaard ex semine A. houstonianum ex Italia) desiccata et in **BPI** 749417 conservata.*

Among many instructive isolates selected by Neergaard in his seed testing work in the 1930's and 1940's was a unique *Alternaria* from Italy-grown seed of *Ageratum houstonianum* Mill. Neergaard (1945) reported the isolate to be pathogenic to seedlings of ageratum in controlled inoculation studies.

Long available as **CBS** 111.44, where it was deposited as *A. porri* (Ellis) Cif. f. sp. *solani* (Ellis & Martin) Neergaard, this isolate is neither *Alternaria solani* Sorauer nor *A. agerati* Sawada ex Simmons. The three species, and many others, have some characters in common (relatively large conidia with filiform beaks), but otherwise are distinct from each other (see below).

Colonies of *A. danida* on PCA (7d.) are thin but with abundant, uncrowded conidiophores that arise for the most part directly from radiating surface hyphae. Sturdy conidiophores are simple or often 1-2 branched and commonly in a size range up to ca. 80-150 x 7-8μm.

Conidia are solitary (rarely in chains of 2) at the apex of each primary conidiophore and branch. Juvenile conidia usually are narrowly ellipsoid or long ovoid, initiating development of an apical filiform beak when the

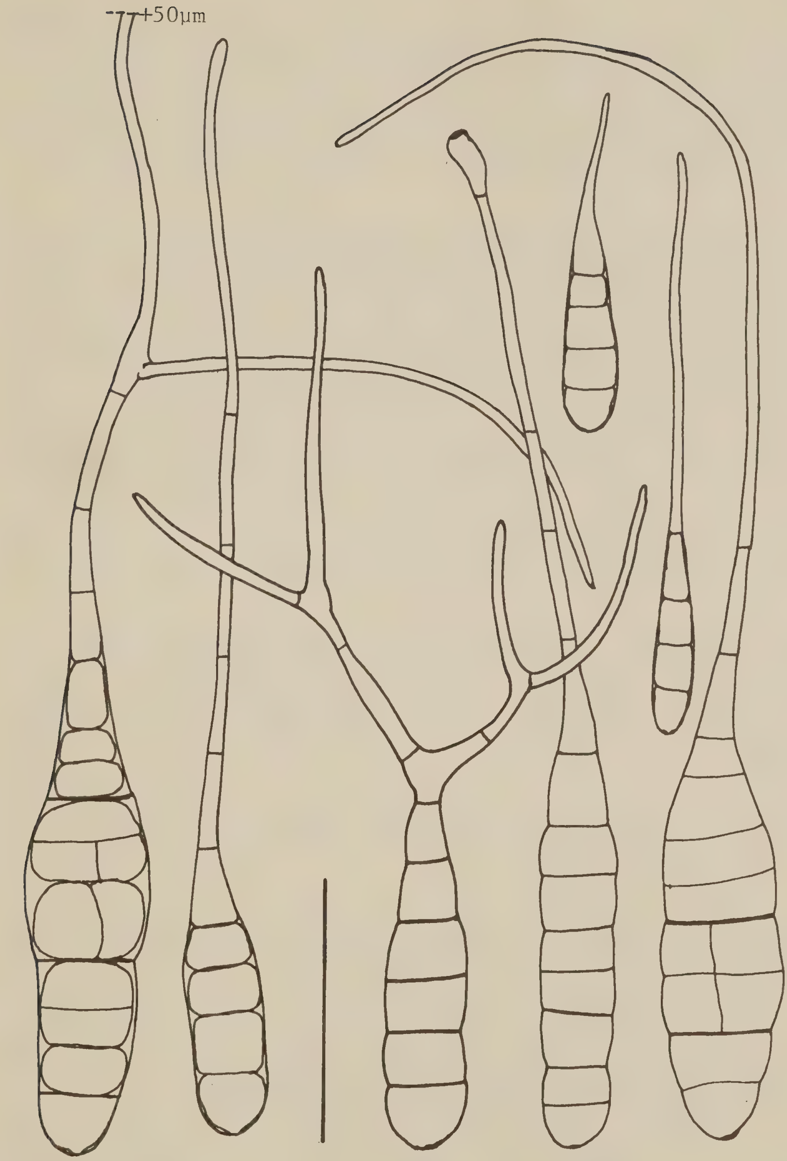

Fig. 149. *Alternaria danida*: conidia and conidiophore from ex-type isolate (EGS 07-029), ex PCA. Bar = 50μm.

conidium body still is only 1-4 distoseptate and ca. 30 x 7μm or less. The conidium then enlarges through a stage when large numbers of spore bodies are practically cylindrical except for the narrowing of 1-2 apical cells. At this intermediate stage the 7-8 transverse walls usually all are distoseptate, although sometimes 1-2 eu-transepta are visible in the spore body, which is ca. 70-80 x 13-17μm in size.

In further development, the conidium usually swells in its central half, eventually becoming broadly ellipsoid. The mature conidium body is essentially smooth, a dilute, dull yellow-tan, ca. 95-120 x 23-26μm, with 6-11 transverse walls, of which 2-3 usually are eusepta laid down through the distosepta; a single longitudinal distoseptum may be produced in each of 2-3 of the broadest transverse segments.

Practically every conidium has a filiform beak, initiated at a very early stage and quickly developing to a size range of ca. 175-250 x 3-4μm. The beak very frequently produces a single branch or rarely a more complex system of secondary branches (yielding 4 beak tips). The tip of a filiform beak occasionally (rarely) becomes converted into a secondary conidiophore, yielding a chain of two conidia.

Chains of conidia are rare in cultures of *A. danida*, but common to dominant in comparable ones of, e.g., *A. agerati* (*Alt.T&V* 211), *A. tagetica* (*Alt.T&V* 219), and *A. zinniae* (*Alt.T&V* 210). Branching of the filiform beak is common in *A. danida* but not found in cultures of the other three.

221. **Alternaria carolinaeana** Unamuno (1941), An Jard. Bot., Madrid, 1: 15.

Holotype [**MA**]: *in foliis Dahliae variabilis prope Mundaca (Vizcaya) ubi collegit P. Unamuno; 6-IX-1935; No. 10872; determ. P. Unamuno*; (EGS 12-099).

The original collection of spotted dahlia leaves exists. However, leafspots have yielded so few conidia, and these mostly collapsed or otherwise distorted, that labeling them holotype can be done only as a formality.

The type description and associated illustration report ellipsoid, cylindrical, clavate conidia with a narrow apical portion, 7-15 transepta, 1 longiseptum in each of 3-5 of the transverse segments, 43-150 x 10.7-21.5μm.

The apical region illustrated for most conidia narrows gradually, appears sturdy rather than filiform, and constitutes one-fourth to one-half the overall length of the spore. Cells are drawn as though they were thickwalled, perhaps distoseptate, which suggests that the fungus might be a species of *Nimbya*. The condition of the type material does not permit a decision on genus placement, much less a useful review of the species.

It is noteworthy the V. G. Rao (1965) reported a similar fungus on leaf spots of dahlia collected by him in Poona, India. Rao described and illustrated conidia with the same general dimensions and narrowed beak region, and identified the specimen as *A. carolinaeana*. The conidial beaks of the Rao specimen are drawn as long and subfiliform, the conidium septation as distinctly distoseptate, and the conidia lacunate. Thus, there is the possibility that there is a distinguishable narrow-beaked *Alternaria* or *Nimbya* species associated with dahlia leafspots that needs to be described more precisely.

222. **Alternaria blumeae** Simmons & Sontirat, sp. nov.

Fig. 150

Ex cultura in agaro V-8 descripta. Conidiophora simplicia, aliquando ramosa vel geniculata, ad 125-320 x 5.0-6.5µm. Conidia solitaria, juventute longiovoidea vel longicylindrica, punctulata, in apice conica, erostrata, ca. 60-70 x 10-12µm et 7-10 transeptata tempore rostri formandi; conidia matura longiellipsoidea, longiovoidea vel saepe longiobovoidea, dilute luteobrunnea, ad 85-128 x 20-25µm, 7-10 transeptata et ex parte 1-2 longiseptata, cellula basali subhemispherica vel longa et late protracta; rostello filamentoso ad 45-85 x 2µm.

Habitatio typi in foliis Blumea aurita DC., Yala Rubber Experiment Station, Ampoe Muang, Yala Province, Thailand. Holotypus: pars ex cultura EGS 40-149 (isol. P. Sontirat ex laesione folii, coll. Pattana Sontirat, 18 January 1992, Yala Province, Thailand) desiccata et in BPI 749418 conservata.

The original host specimen of leaves with lesions was collected in the southernmost province of Thailand during field work of the Division of Plant Pathology, Department of Agriculture, Bang Khen, Thailand.

Growth is excellent and sporulation prolific on PCA, Hay, and V-8 agars. The abundant, sometimes crowded primary conidiophores that arise directly from the agar surface reach sizes of ca. 125-320 x 5.0-6.5µm. Particularly dense stands of conidiophores and conidia are produced in light-exposed concentric circles of V-8 colonies; dark-period circles have moderately abundant aerial hyphae which bear a scattering of conidiophores and spores.

Sturdy primary conidiophores on PCA are straight or variously curved. They usually remain simple and solitary. However, other erect conidiophores typically branch and extend geniculately at the apex, producing a cluster of conidia, some of which themselves add to the cluster by producing short lateral conidiophores from the spore body.

The character of single (seldom 2-catenate) conidia dominates PCA and V-8 colonies, but on hay decoction agar a strong majority of primary conidia produce secondary conidia, not only from an apical conidiophore but also quite commonly from secondary conidiophores that arise from one or more lateral cells of primary conidia.

Juvenile conidia are long-cylindrical, tapering in their upper quarter to a conical, erostrate apex. The conidium base usually is rounded and unremarkable. In some cases, however, it is almost flat, with the pigmented hilum region very conspicuous and even slightly protuberant outside the curvature of the base. This flat-base character, though not dominant, sometimes carries through into fully developed conidia. The conidium body initially is evenly and conspicuously punctulate overall. Outer wall ornamentation becomes finer and obscure on some developing conidia, or it may develop into maturity as an easily observed punctate or (rarely) verrucate roughening.

The beak usually begins development when young conidia are ca. 60-70 x 10-12μm and already have several (up to 7-10) transepta, although beak initiation may be delayed until the conidium body is as long as 100μm. Earliest evidence of beak initiation usually is a slight enlargement of the apical cell or of a short apical extension, which then narrows and proceeds to evolve into a filiform beak.

Fully developed conidium bodies are long-ellipsoid, sometimes long-ovoid, or often strikingly obovoid with the greatest width above the middle of the conidium. Equally remarkable is the tendency of the base cell of the conidium to become long and broadly tapered in contrast to the usual subhemispherical shape of most *Alternaria* conidium bases. Conidium bodies are dilute yellow-brown, have a variety of fine to punctate wall ornamentations, and reach a size range of 85-128 x 20-25μm; the 2μm diam. filiform beak adds as much

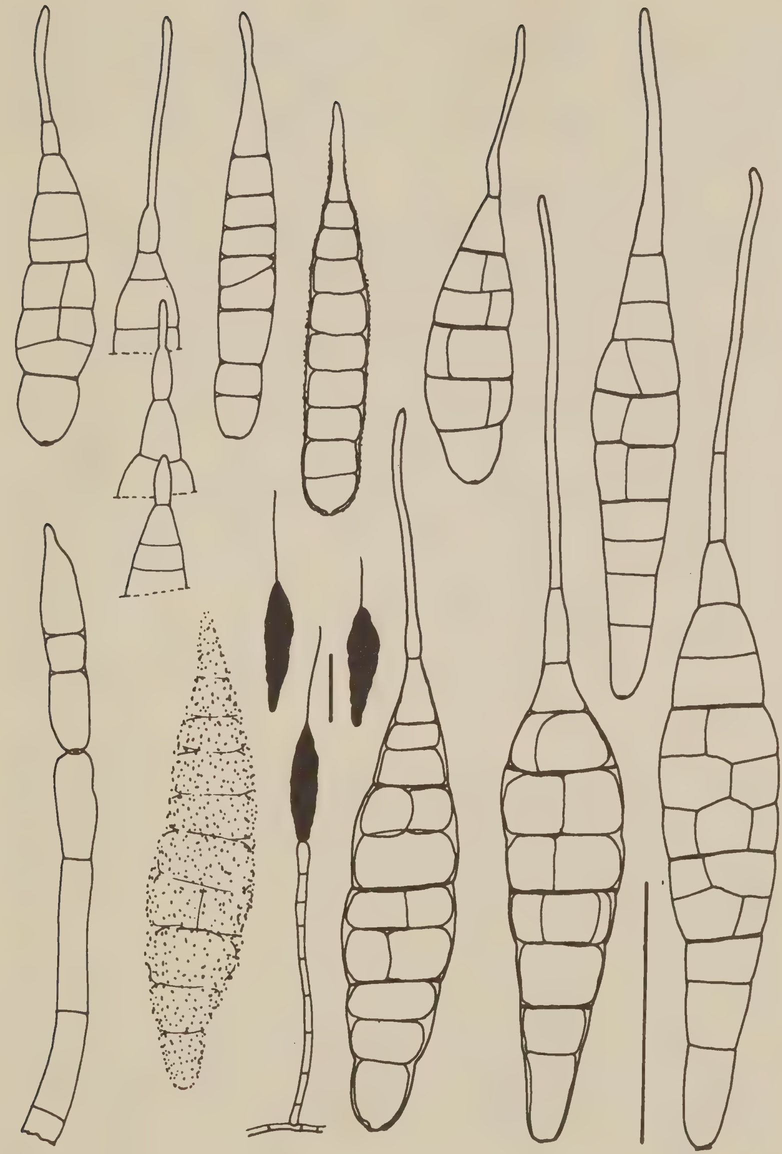

Fig. 150. *Alternaria blumeae*: conidia and conidiophores from ex-type isolate (EGS 40-149), ex V-8. Bars = 50μm.

as 45-85μm to the total length of conidia. Although all internal divisions of *A. blumeae* conidia initially are distoseptate, transverse and longitudinal eusepta are inserted early and in relative abundance. Conidia mature with 7-10 transepta and 1-2 longisepta in some of the transverse divisions.

Alternaria blumeae and *A. agerati* (*Alt.T&V* 211) are similar in several cultural and microscopic characters. The following observations are based on 7d. cultures on V-8 agar (plus one character from Hay decoction agar).

Alternaria agerati conidia tend to remain solitary on all media since secondary conidiophore production is relatively minor. The basal cell of conidia sometimes is longer than wide, but this is not a conspicuous character. Mature conidia have body lengths mostly in an 80-100μm range.

Alternaria blumeae conidia are predominantly solitary, except that on Hay agar they typically are in short chains and often form small clumps due to ready production of secondary conidiophores and conidia laterally from cells of primary conidia. Conidia have longisepta in most of the transverse segments, which results in a more cellular, dictyosporic appearance than is seen in *A. agerati* conidia of the same age. The basal cells, and often even the lower half of many *A. blumeae* conidia are strikingly narrow and elongate.

In general, mature *A. blumeae* conidium bodies are somewhat longer (ca. 85-128μm) than *A. agerati* conidia of the same age (ca. 80-100μm). Conidium width range is about the same in both species, but the strongly tapered base of large numbers of *A. blumeae* conidia gives an entirely different picture when compared with the broader ellipsoid curve of *A. agerati* spore bodies.

223. **Alternaria nattrassii** Simmons, sp. nov. Fig. 151

Etym.: eponymous of R. M. Nattrass, whose *A First List of Cyprus Fungi* (1937) included *A. cichorii* Nattrass and possibly would have mentioned this new species if it had been collected earlier than in 1938.

Conidia solitaria, juventute ovoidea mox latirostrata; maturitate late ovoidea vel late ellipsoidea, ad ca. 100-150 x 23-32μm, 8-12 transverse et 7-9 longiseptata, dilute brunnea, laevia, rostro angusto, simplici ad 65-105 x 3μm.

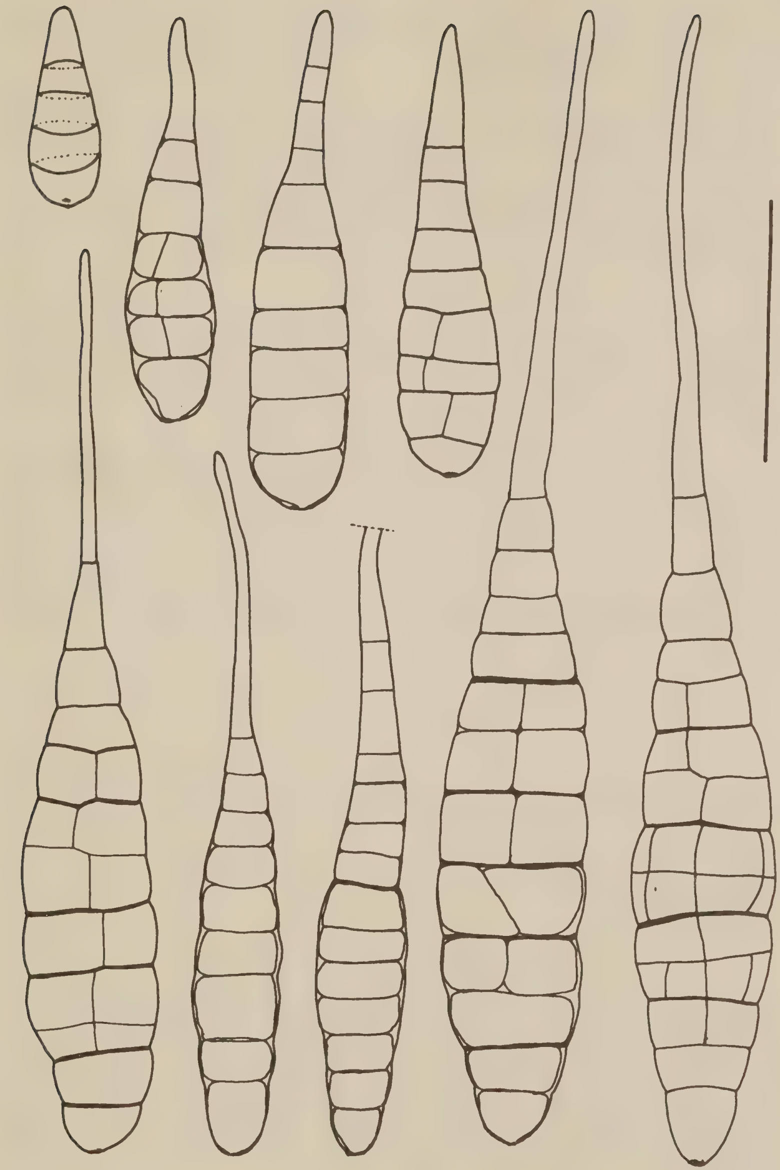

Fig. 151. *Alternaria nattrassii*: conidia ex holotype specimen (EGS 24-084). Bar = 50μm.

Habitatio typi in laesionibus foliorum Cirsium sp. Holotypus: IMI 996, coll. R. M. Nattrass no. 895, Feb. 1938, Polis, Cyprus; (EGS 24-084).

Field conidia of *A. nattrassii* become about twice as large as conidia of *A. cirsinoxia* from inoculated leaves of *Cirsium arvense* (*Alt.T&V* 218). In addition, *A. cirsinoxia* conidia become conspicuously ornamented and often have branched as well as simple beaks, characters not found in the type of *A. nattrassii*.

The relatively large conidia of *A. nattrassii* are solitary; evidence of chain formation was not found in the preparation from type. Young conidia are ovoid, initiating growth of a sturdy, upward-narrowing apical extension after the spore body has developed a few transverse distosepta.

Fully developed conidia are broadly ovoid or broadly ellipsoid, pale brown, smooth-walled, and have 8-12 transverse septa and 1-3 longitudinal septa in some of the wider transverse segments. Early walls are distosepta, through a few of which eusepta are laid down as the conidia mature. Conidia may become as large as 250 x 32μm overall, with a body size range up to ca. 100-150 x 28-32μm and simple beaks to ca. 65-105 x 5μm tapering to 3μm.

ACKNOWLEDGEMENTS

The goodwill and generous support of mycologists, phytopathologists, and institutions in lending or supplying conserved and fresh material for use in these studies continue to be appreciated. I have tried in the text to identify each institution and to acknowledge by name each colleague whose specimens or cultures have been cited. May they flourish.

Dr. Mary E. Palm once again has done me the kindness of reviewing the penultimate manuscript draft, extracting sufficient time from her increasing duties as President-elect of the Mycological Society of America to note those things I ought to have done as well as others I ought not to have done. Dr. Rodney G. Roberts also has reviewed the manuscript of these notes, taking time from a hectic schedule of reviving his own programs after an extended period in New Zealand.

I am especially grateful to these two individuals for their perennial encouragement and support in matters related to my *Alternaria* studies. Likewise, may they flourish.

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NOTES ON CONIDIAL FUNGI. XIV. NEW HYPHOMYCETES FROM CUBA

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ABSTRACT

Four new taxa collected from rain forests in Cuba are described and illustrated.They are: ***Anungitea brevicatenata*** anam. sp. nov., characterized by cylindrical, pale brown, verrucose conidia, in short chains; ***Hyalodendron oudemansiellicola*** anam. sp. nov., distinguished by polymorphic conidia; ***Parasympodiella inaequiseptata*** anam. sp. nov., which shows inequilateral, clavate, truncate conidia, in short chains and ***Trichoconis antillana*** anam. sp. nov., characterized by 4-septate, inequilateral conidia. Key of accepted species of ***Anungitea*** is provided.

Key words: ***Anungitea***, ***Hyalodendron***, ***Parasympodiella***, ***Trichoconis*** systematics, tropical fungi, Cuba.

RESUMEN

Se describen e ilustran cuatro nuevos taxones colectados en bosques tropicales de Cuba. Dichos taxones son: ***Anungitea brevicatenata*** anam. sp. nov., caracterizada por conidios cilíndricos, de color pardo claro y verrucosos, formando cadenas cortas; ***Hyalodendron oudemansiellicola*** anam. sp. nov., que se distingue por sus conidios polimórficos; ***Parasympodiella inaequiseptata*** anam. sp. nov., que presenta conidios claviformes, con lados desiguales y con la base truncada, formando cortas cadenas; ***Trichoconis antillana*** anam. sp. nov., caracterizada por conidios con cuatro septos y lados desiguales. Se propone una clave para las especies de ***Anungitea***.

Palabras clave: ***Anungitea***, ***Hyalodendron***, ***Parasympodiella***, ***Trichoconis*** sistemática, hongos tropicales, Cuba.

TAXONOMIC PART

Anungitea brevicatenata Castañeda, Kendrick et Guarro, *anam. sp. nov.*
Figs 1, 2

Ad fungos conidiales, hyphomycetes pertinens. Coloniae effusae, pilosae, hypophyllae, brunneae. Mycelium partim superficiale et partim in substrato immersum, ex hyphis septatis, ramosis, laevibus, brunneis, 1-2 µm diam compositum. Conidiophora conspicua, mononematosa, erecta, recta vel flexuosa, 3-6 septata, eramosa, laevia, brunnea ad basim, dilute brunnea ad apicem, 60-130 x 4-5 µm ad fundamenta. Cellulae conidiogenae polyblasticae, sympodiales, terminales, interdum intercalares,13-18 x 3-5 µm, in conidiophoris incorporatae, denticulatae, denticulis conspicuis, cylindricis praeditae. Conidia cylindrica usque clavata, breve blastocatenata, sicca, saepe microverrucosa, dilute brunnea, 0-1-septata; conidia primaria cylindrica usque ovoidea, interdum leviter clavata, truncata ad basim et rotunda ad apicem, 14-17 x 3 µm; conidia secundaria cylindrica, subtruncata ad basim et rotunda ad apicem, 12-14 x 3 µm. Teleomorphosis ignota.

Substratum: *In foliis dejectis Mimusopium commersoniis*, Santiago de las Vegas, C. Habana, Cuba. Leg. R. F. Castañeda, 15-II-1992
Holotypus: INIFAT C92/18, Santiago de las Vegas, Cuba.
Isotypus: MUCL 39866

Conidial fungi, hyphomycetes. Colonies effuse, hypophyllous, brown. Mycelium superficial and immersed. Hyphae branched, septate, smooth-walled, brown, 1-2 µm diam. Conidiophores differentiated, mononematous, erect, straigth or flexuous, septate, unbranched, smooth-walled, brown at the base, pale brown above, 60-130 x 4-5 µm. Conidiogenous cells polyblastic, sympodial, terminal, sometimes intercalary, 13-18 x 3-5 µm, integrated, with conspicuous, cylindrical denticles. Conidia cylindrical to clavate, in acropetal chains, dry, minutely verrucose, pale brown, 0-1-septate; primary conidia cylindrical, truncate at the base and rounded at the apex, 14-17 x 3 µm; secondary conidia cylindrical to clavate, subtruncate at the base and rounded above, 12-14 x 3 µm. Teleomorph unknown.

Substrate: On dead leaf of *Mimusops commersonii*. Santiago de las Vegas, C. Habana, Cuba. Coll. R. F. Castañeda, February 15, 1992.
Holotype: INIFAT C92/18, Santiago de las Vegas, Cuba.
Isotype: MUCL 39866
Other specimen examined: INIFAT C92/19-2 = MUCL 39881, on dead leaf of *Mimusops commersonii*, Santiago de la Vegas, La Habana, Cuba. R.F. Castañeda, 2.II.1992.
Cultures deposited: INIFAT C92/18 = IMI 353674; INIFAT C92/19-2 = IMI 353676.

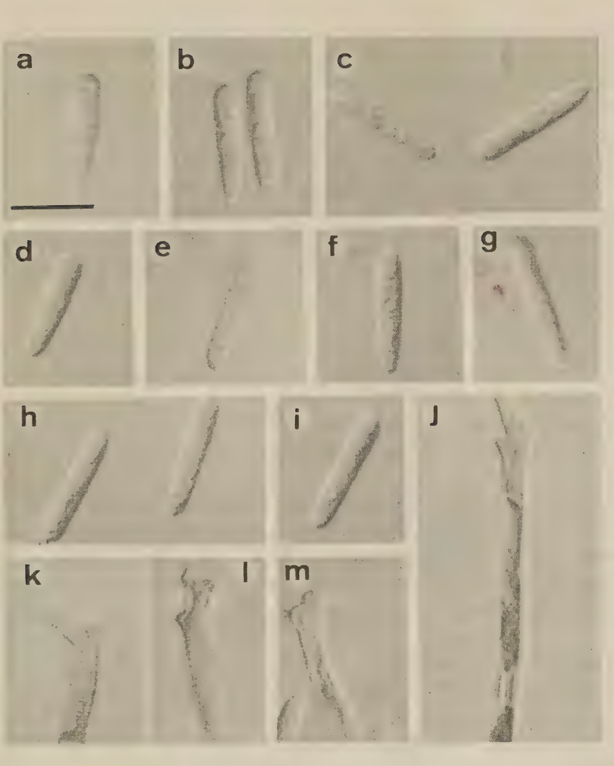

Fig. 1 a-j. ***Anungitea brevicatenata*** INIFAT C92/18. Bar = 10 µm.

The genus ***Anungitea*** Sutton (1973) is characterized by conidia borne on conspicuous denticulate loci of the terminal or intercalary conidiogenous cells and forming acropetal, unbranched chains. A number of species have been added to the genus since the type species ***A. fragilis***, was described by Sutton (1973): ***A. continua*** Matsushima (1975) (Kirk, 1983); ***A. longicatenata*** Matsushima (1975); ***A. triseptata*** Matsushima (1975); ***A. uniseptata*** Matsushima (1975); ***A. globosa*** Sutton & Hodges (1978); ***A. heterospora*** P. M. Kirk (1983); ***A. rhabdospora*** P. M. Kirk (1983); ***A. antillana*** Castañeda (1986); ***A. occidentalis*** Castañeda & Kendrick (1990); ***A. palustris*** Castañeda & Kendrick (1991); ***A. parvispora*** Castañeda & Kendrick (1991); ***A. caespitosa*** Crous, Kendrick & Wingfield (1995) and ***A. syzygii*** Crous, Kendrick & Wingfield (1995). ***Anungitea triseptata*** was transferred to ***Anungitopsis*** Castañeda & Kendrick (1990), as ***Anungitopsis triseptata*** (Matsushima) Castañeda & Kendrick (1991). Its conidiogenous loci are different from those of ***Anungitea*** and conidial pigmentation is also different. On the basis of the original description it would appear that ***A. continua*** is not congeneric with ***A. fragilis*** because the former has branched chains (Sutton &

Hodges, 1978), but Kirk (1983), after examining several collections of ***A. continua*** from *Pinus* spp., demonstrated that the chains of conidia are unbranched. Kirk (1982) considered ***A. globosa*** a synonym of ***A. fragilis***, a decision supported by Matsushima (1987) and by Castañeda Ruíz et al. (1996) on the basis of a recent collection from rotten leaf from Spain. ***Anungitea brevicatenata*** resembles ***A. fragilis*** in the pigmentation of its conidia, but the shape, ornamentation and size of their conidia differ. ***Anungitea fragilis*** has cylindrical, smooth-walled conidia measuring 10-13 x 1.5 µm . ***Anungitea occidentalis*** Castañeda & Kendrick (1990) has similar conidia, but they are clavate. The conidia of ***A. brevicatenata*** resemble those of ***A. syzgii*** in shape, but those of ***A. syzgii*** are smooth-walled.

KEY TO SPECIES OF *ANUNGITEA*

1. Setae and/or setose conidiophores present 2
1'. Setae and/or setose conidiophores absent 3

2. Primary and secondary conidia identical, cylindrical, 1-septate, 10-13 x 1,5 µm, smooth, pale olivaceous brown. Setae absent .... ***A. fragilis***
2'. Primary conidia clavate, secondary conidia clavate to ellipsoidal, conidia non-septate, 11-20 x 3.0-3.5 µm, smooth, hyaline. Setae hyaline to brown, 50-340 x 3.5-5.0 µm .... ***A. caespitosa***

3. Conidia usually non-septate 4
3'. Conidia usually with more than 1septum 12

4. Conidia always non-septate, cylindrical, 7-12 x 1-2 µm, subhyaline, guttulate, smooth .... ***A. continua***
4'. Conidia not as above 5

5. Conidiogenous cells sometimes discrete on very short side branches. Conidia cylindrical to fusiform, occasionally naviculate, 15-21 x 2 µm, hyaline, smooth .... ***A. palustris***
5'. Conidiogenous cells always integrated 6

6. Conidia constricted at septa, ellipsoidal, 5-8 x 2.5-3.0 µm, hyaline, smooth .... ***A. parvispora***
6'. Conidia not constricted at septa 7

7. Conidia verrucose, pale brown; primary conidia cylindrical, 4-17 x 3 µm; secondary conidia cylindrical to clavate, 12-14 x 3 µm. .... ***A. brevicatenata***
7'. Conidia smooth 8

8. Conidia cylindrical 9
8'. Conidia clavate to ellipsoidal 11

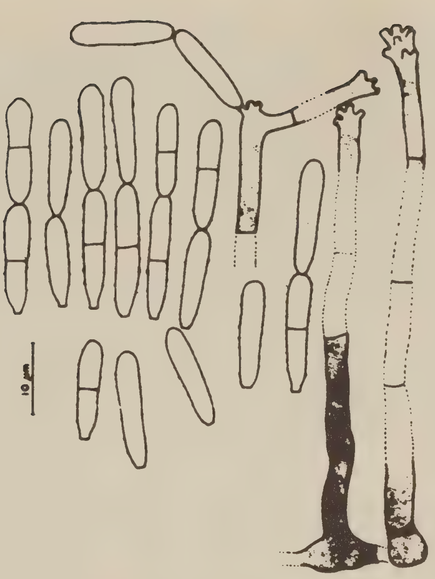

Fig. 2. ***Anungitea brevicatenata*** INIFAT C92/18.

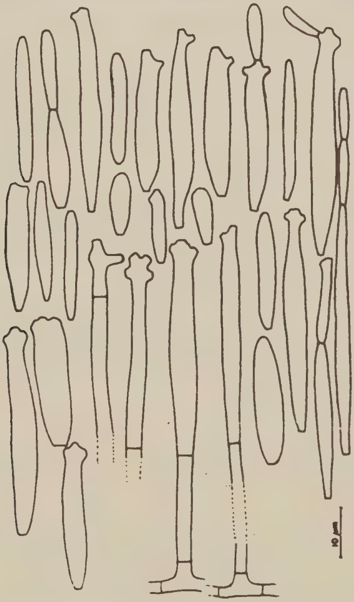

Fig. 3.- ***Hyalodendron oudemansiellicola*** INIFAT C91/227.

9. Conidia 12-18 x 0.7-1 µm, pale olivaceous brown .... ***A. rhabdospora***
9'. Conidia not as above 10

10. Primary and secondary conidia 12-17 x 2.0-2.8 µm, hyaline, guttulate.............. .... ***A.uniseptata***
10'. Primary conidia 8.0-9.5 x 3-4 µm; secondary conidia 9-16 x 2.5- 3.0 µm; conidia hyaline, guttulate.. ***A. heterospora***

11. Conidia 9-12 x 2 µm, clavate, hyaline...................................... ***A. occidentalis***
11'. Conidia 8-15 x 2-5 µm, sub-ellipsoidal to sub-cylindrical, hyaline to pale brown .... ***A. syzgii***

12. Conidia 0-2 -septate, obovoid to cylindrical, 11-18 x 2.5-4.0 µm, hyaline, smooth.. ***A. longicatenata***
12'. Conidia 4-7-septate, cylindrical, 25-44 x 3.5-5.0 µm, pale brown, smooth........... .... ***A. antillana***

Hyalodendron oudemansiellicola Castañeda, Kendrick et Guarro, *anam. sp. nov.*

Figs 3, 4 b,e-i

Ad fungos conidiales, hyphomycetes pertinens. Coloniae effusae, velutinae usque caespitosae, hygroscopicae, albae. Mycelium partim superficiale et partim in substrato immersum, ex hyphis septatis, ramosis, laevibus, hyalinis, 1.5-2.0 µm diam. compositum. Conidiophora conspicua, mononemata, plerumque non-ramosa, raro ramosa, erecta, recta vel flexuosa, septata, laevia, hyalina, usque 200 µm alta et 2-4 µm crassa ad basim. Cellulae *conidiogenae polyblasticae vel monoblasticae, terminales, raro intercalares, integratae, denticulatae, leviter cicatricatae, hyalinae. Ramoconidia vermiformia, leviter attenuata ad basim, unicellularia, 20-45 x 3-4 µm, laevia, hyalina, hygroscopica.* Conidia *blastocatenata, polymorpha, cylindrica, fusiformia interdum filiformia, raro ellipsoidea, 0-septata, 10-26 x 2-3.5 µm. tenui-tunicata, hygroscopica, laxa, plerumque aspecto mucosa in massa, hyalina, laevia. Teleomorphosis ignota.*

Substratum: In basidiomatae *Oudemansiellae canariis,* Santiago de las Vegas, C. Habana, Cuba. Leg. R.F. Castañeda, 10-XII-1991.
Holotypus: INIFAT C91/227, Santiago de las Vegas, C. Habana, Cuba.
Isotypus: MUCL 39875

Conidial fungi, hyphomycetes. Colonies effuse, velvety to caespitose, hygroscopic, white. Mycelium superficial and immersed. Hyphae septate, branched, smooth-walled, hyaline, 1.5-2.0 µm diam. Conidiophores differentiated, mononematous, unbranched, rarely branched, erect, straight or flexuous, septate, smooth-walled, hyaline, up to 200 µm tall, 2-4 µm wide at the base. Conidiogenous cells polyblastic or monoblastic, terminal, rarely intercalary, integrated, denticulate, slightly scarred, hyaline. Ramoconidia worm-shaped, slightly attenuated at the

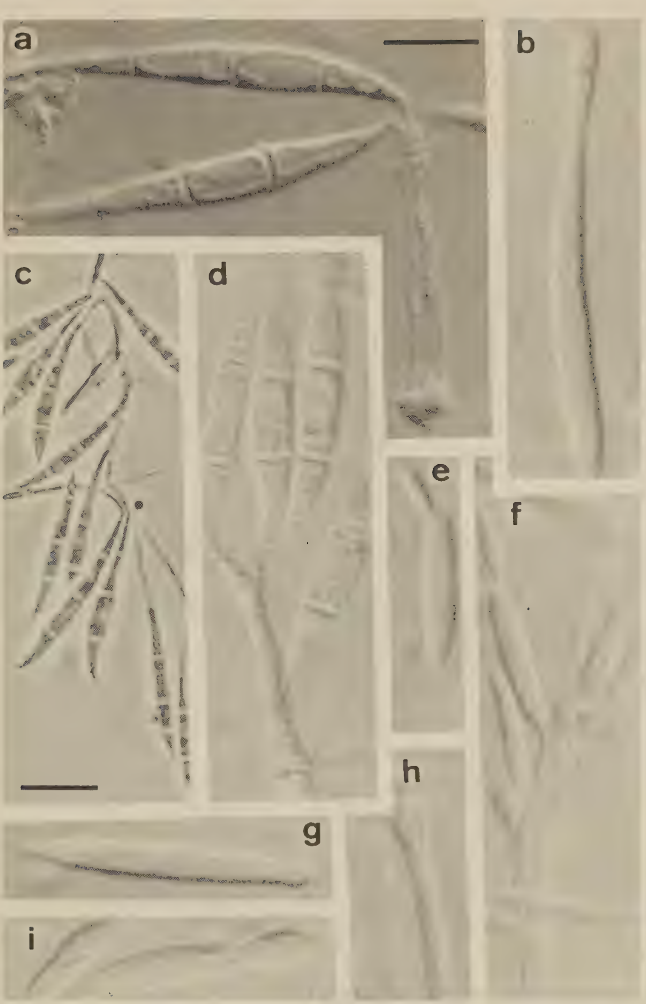

Fig. 4. a,c,d. ***Trichoconis antillana*** INIFAT C91/199. b,e-i. ***Hyalodendron oudemansiellicola*** INIFAT C91/227. Bar = 10 µm (in c, bar = 20 µm).

base, non-septate, 20-45 x 3-4 µm, smooth-walled, hyaline, hygroscopic. Conidia acropetal branched chains, polymorphic, cylindrical, fusiform, filiform, rarely ellipsoid, non-septate, 10-26 x 2-3.5 µm thin-walled, hygroscopic, appearing flaccid, accumulating in mucus, hyaline, smooth-walled. Teleomorph unknown.

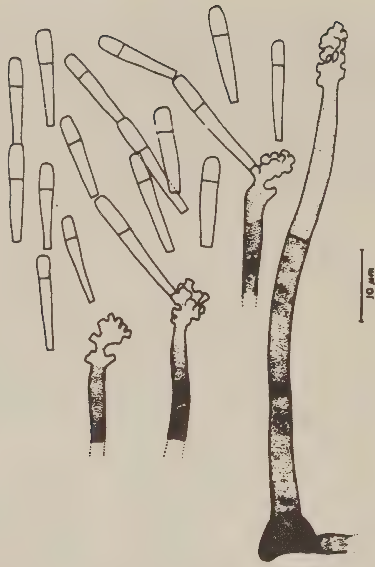

Fig. 5.- ***Parasympodiella inaequiseptata*** INIFAT C92/73.

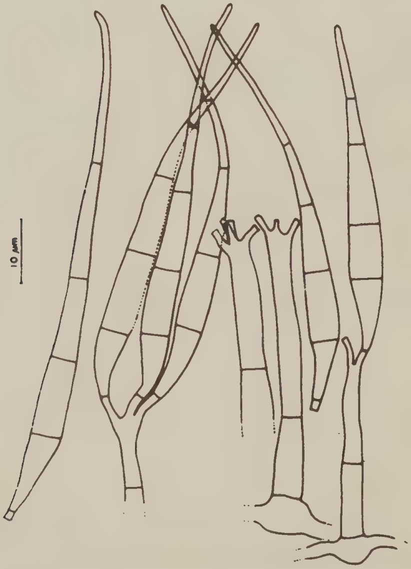

Fig. 6. ***Trichoconis antillana*** INIFAT C91/199.

Substrate: On basidiomata of *Oudemansiella canarii*, Santiago de las Vegas, C. Habana, Cuba. Coll. R.F. Castañeda, December 10, 1991.

Holotype: INIFAT C91/227, Santiago de las Vegas, C. Habana, Cuba.
Isotype: MUCL 39875
Culture deposited: INIFAT C91/227 = IMI 353671

Hyalodendron Diddens (Barron,1968; Carmichael *et al.*, 1980) is distinguished by polyblastic conidiogenous cells and unicellular conidia in acropetal, branched chains. The type species, ***Hyalodendron lignicola*** Diddens (de Hoog, 1979) differs from ***H. oudemansiellicola*** in having budding cells produced by locally detached conidia; while the conidia are ellipsoidal to subcylindrical, 5-15 x 1.6-3 µm and in old cultures pale olivaceous, smooth-walled, saturnoid to globose, chlamydospores-like structures have been reported, which are absent in ***H. oudemansiellicola***. Matsushima (1975), described a fungus as ***Hyalondendron*** sp., but it is clearly different from ***H. oudemansiellicola***.

Parasympodiella inaequiseptata Castañeda, Kendrick et Guarro, *anam. sp. nov.*
Figs 5, 7

Ad fungos conidiales, hyphomycetes pertinens. Coloniae effusae, pilosae, amphigenae, albo-brunneae. Mycelium partim superficiale et partim in substrato immersum, ex hyphis septatis, ramosis, brunneis, laevibus, 1-1.5 µm diam. compositum. Conidiophora conspicua, erecta, curvata, raro recta, cylindrica, non-ramosa, septata, laevia, brunnea ad basim et pallidiora usque hyalina ad apicem, 100-200 µm alta et 5-6 µm crassa ad basim. Cellulae conidiogenae terminales, sympodiales, in conidiophoris incorporatae, indeterminatae, geniculatae, crassa denticulatae. Conidia thallica-arthrica, formata per disarticulationem in septis antea formatis, 2-3-catenata, non-ramosa, clavata, inaequiseptata, 1-septata circa apicem, truncata ad basim et subtruncata ad apicem, sicca, lavia, hyalina, 11-16 x 2-3 µm, 1-1.5 µm crassa ad basim. Teleomorphosis ignota.

Substratum: In foliis dejectis, San Antonio de los Baños, La Habana, Cuba. Leg. R.F. Castañeda, 2 -II-1992

Holotypus: INIFAT C92/73, Santiago de Las Vegas, C. Habana, Cuba.
Isotypus: MUCL 39877

Conidial fungi, hyphomycetes. Colonies spreading, hairy, amphigenous, white-brown. Mycelium partly superficial, partly immersed. Hyphae septate, branched, brown, smooth-walled, 1-1.5 µm diam. Conidiophores differentiated, erect, flexuous, rarely straight, cylindrical, simple, septate, smooth-walled, brown at the base, pale to hyaline towards the apex, 100-200 µm tall and 5-6 µm wide at the base. Conidiogenous cells terminal, sympodial, integrated, indeterminate, geniculate, with broad denticles. Conidia thallic-arthric, formed by disarticulation at previously formed septa, in unbranched chains of 2-3 conidia, clavate, 1-septate, inequilateral, with septum near the apex, truncate at the ends, dry, smooth-walled, hyaline, 11-16 x 2-3 µm, 1-1.5 µm wide at the base, in chains of 2-3 conidia. Teleomorph unknown.

Substrate: On decaying leaf, San Antonio de los Baños, La Habana, Cuba. Coll. R.F. Castañeda, February 2, 1992.
Holotype: INIFAT C92/73, Santiago de Las Vegas, C. Habana, Cuba.
Isotype: MUCL 39877

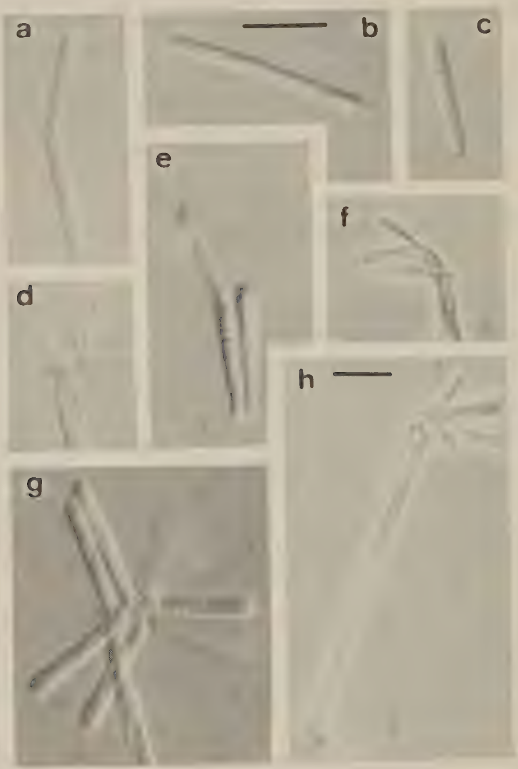

Fig. 7. ***Parasympodiella inaequiseptata*** INIFAT C92/73. Bar, a-e,g = 10 µm; f,h = 12 µm.

The genus ***Parasympodiella*** was established by Ponnappa (1975) with ***P. laxa*** (Subramanian & Vittal) Ponnappa as type species. ***Stylaspergillus*** Sutton, Alcorn & Fisher (1982) was later described as a synanamorph of ***Parasympodiella***. Some additional new species have been described: ***P. clarkii*** Sutton (1978), ***P. minima***

Crane & Schoknecht (1982), ***P. africana*** Morgan-Jones, Sinclair & Eicker (1983); ***P. longispora*** (Tokumasu & Tubaki) Tokumasu (1987); ***P. elongata*** Crous, Wingfield & Kendrick (1995) and ***P. podocarpi*** Crous & Seifert (Crous et al., 1996), but none of these species resemble ***P. inaequiseptata*** in conidial shape and in septum position. Our fungus bears a slight resemblance to ***Solosympodiella clavata*** Matsushima (1975), but in that species the conidia are solitary in each locus. Similar conidium ontogeny also occurs in ***Chikaneea holleroniae*** Sutton (1973), but has been described as holoblastic. ***Sympodiella acicola*** Kendrick (1958) has a long rachis and conidia clearly different from those of ***P. inaequiseptata***. ***Parasympodiella africana*** has "holothallic", terminal and intercalary conidigenous cells bearing a solitary conidium at each conidiogenous locus: it is not considered congeneric with ***P. laxa,*** which is characterized by well-developed conidial chains. It has some resemblances with ***Subulispora britannica*** Sutton (1973), but ***S. britannica*** has polyblastic, sympodial, geniculate, terminal conidiogenous cells whereas in ***P. africana*** each conidogenous cell is delimited by a septum. ***P. africana*** could, in fact, be considered as a hitherto undescribed genus. ***Sympodiella roystoneae*** Mercado & Castañeda (1985) has sympodial, terminal and intercalary conidogenous cells and cylindrical, truncate, 0-2-septate, hyaline, conidia measuring 14-48 x 5-7 µm. The conidia are in chains and it is considered here as a synonym of ***P. laxa***. ***Polyscytalum harae*** (Sutton) P. M. Kirk (1981) (≡ ***Subulispora harae***) has also some affinities with ***Parasympodiella***, producing cylindrical, 1-3-septate conidia in unbranched chains, which fragment, but we would need to examine more collections before making any taxonomic decision. Therefore, no new combination is proposed.

Trichoconis antillana Castañeda, Kendrick et Guarro, *anam. sp. nov.*

Figs 4 a,c,d, 6

Ad fungos conidiales, hyphomycetes pertinens. Coloniae effusae, velutinae usque funiculosae, albae. Mycelium plerumque superficiale, ex hyphis septatis, ramosis, laevibus, hyalinis, 1-1.5 µm diam. compositum. Conidiophora conspicua, erecta, recta vel flexuosa, non-ramosa, septata, laevia, hyalina, inflata ad basim vel irregularia, usque 55 µm alta et 6-10 µm crassa ad fundamenta. Cellulae conidiogenae polyblasticae, discretae, lavia, sympodiales, denticulatae, denticulus cylindricis manifestis, 2-3.5 µm longis praeditae. Conidia acrogena, obclavata, rostrata, inaequilateralia, 4-septata, sicca, laevia, hyalina, 50-120 x 4-6 µm, reliquiis cellulis conidiogenis praedita. Teleomorphosis ignota.

Substratum: In setarum *Beltraniae rhombicae* in foliis dejectis *Pimentae dioicae*, Santiago de las Vegas, La Habana, Cuba. Leg. R. F. Castañeda, 2-XI-1991

Holotypus: INIFAT C91/199, Santiago de las Vegas, Cuba.

Isotypus: MUCL 39871

Conidial fungi, hyphomycetes.Colonies spreading, velvety to funiculose, white. Mycelium mostly superficial. Hyphae septate, branched, smooth-walled, hyaline, 1-

1.5 µm diam. Conidiophores differentiated, erect, straight or flexuous, unbranched, septate, smooth-walled, hyaline, inflated at the base or irregular, up to 55 µm tall and 6-10 µm wide at the base. Conidigenous cells polyblastic, discrete, smooth, sympodial, denticulate, with conspicuous cylindrical denticles, 2-3 *µm* long. Conidia apical, obclavate, rostrate, inequilateral, 4-septate, dry, smooth-walled, hyaline, 50-120 x 4-6 µm, with some remains of conidiogenous cells attached at the base. Teleomorph unknown.

Substrate: On setae of *Beltrania rhombica* on dead leaf of *Pimenta dioica*, Santiago de las Vegas, La Habana, Cuba. Coll. R.F. Castañeda., November 2, 1991.

Holotype: INIFAT C91/199, Santiago de las Vegas, Cuba.

Isotype: MUCL 39871

The previously decribed species of ***Trichoconis*** Clements (Deighton & Pyrozynski, 1972; Hawksworth, 1981; Matsushima, 1989; Castañeda & Kendrick, 1991) clearly differ from ***T. antillana*** in the shape, number of cells and size of their conidia. Only ***T. caudata*** (Appel & Strunk) Clements bears some resemblance with ***T. antillana*** but their conidia are usually 5-septate, measuring 41-70 x 8-9 µm.

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MYCOTAXON

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A NEW SPECIES OF AMAURODON (BASIDIOMYCOTA, APHYLLOPHORALES)

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Amaurodon hydnoides sp. nov. is described from Venezuela. The relationships with other species of *Amaurodon* J. Schröt are discussed.

During a collection trip to the Venezuela, one of us (L. R.) found a deep blue resupinate species growing on dead wood. After drying the bluish hymenophore turned greenish, which is a common colour reaction for species of *Amaurodon*. The hymenophore is a strongly hydnoid - feature, occasionally present in *A. viridis* (Alb. & Schwein.: Fr.) J. Schröt. but never so prominently, and there are always entirely smooth areas of hymenophore in that species. Further studies using light and scanning electron (SEM) microscopes showed that specimen belongs to an undescribed taxon.

For light microscopic studies, samples were mounted in 3% KOH. Drawings were made using Nikon drawing tube attached to the Nikon Labophot 2 microscope at magnifications x1250 and x750. For the protocol of SEM studies, see Kõljalg (1996). The colour names are given according to Rayner (1970), and colour indices according to the Munsell (1976) colour system.

AMAURODON HYDNOIDES Kõljalg & Ryvarden sp. nov.

Carposomata effusa, separabilia. Hymenophorum subcaeruleum, luteolo-viride, hydnaceum. Rhizomorphae nullae. Hyphae subiculi septato-nodosae, 2-4 µm latae, tenuiter vel crasse tunicatae, incrustatae, luteo-fuscae vel violaceae in solutione KOH. Hyphae tramae septato-nodosae, 2.5-5 µm latae, tenuiter tunicatae, incrustatae, hyalinae vel violaceae in solutione KOH. Hyphae subhymenii septato-nodosae, 3-4 µm latae, tenuiter tunicatae, incrustatae, hyalinae vel violaceae in solutione KOH. Cystidia nulla.

Basidia 18-40 x 4-6.5 µm, utriformia, flexuosa, hyalina vel violacea in solutione KOH, 4 sterigmatibus. Sporae 4.4-5.6 x 3.2-3.8 µm, ellipsoideae, verruculosae, luteo-fuscae vel violaceae in solutione KOH.

Holotype: Venezuela. Estado Bolivar, Las Nieves, on dead deciduous wood. 11 June 1995. L Ryvarden 37576 (VEN, isotypes: O, K, TAA)

Basidiocarp resupinate, mostly separable from the substratum, arachnoid, continuous. Hymenophore bluish when fresh, yellow-green when dry, nearly Herbage Green to Dark Herbage Green (nearly 2.5 GY 6/4 or 6/6) when dry, strongly hydnoid, teeth up to 2 mm long, cylindric, concolorous with subiculum.

Hyphal cords absent. Subicular hyphae clamped, 2-4 µm diam, thin- or thick-walled, encrusted, yellowish brown or partly violet in 3% KOH. Hymenophoral trama present, teeth with sterile apex, tramal hyphae cystidia like, clamped, 2.5-5 µm diam, thin-walled, strongly encrusted; there are some very large crystals in trama (see Fig. 2), hyaline to yellowish brown or partly violet in 3% KOH. Subhymenial hyphae clamped, 3-4 µm diam, thin-walled, encrusted, hyaline or partly violet in 3% KOH. Cystidia absent.

Basidia 18-40 µm long, 4-6.5 µm diam at apex, clamped at base, utriform, not stalked, often sinuous, without transverse septa, hyaline in distilled water, hyaline, greenish or partly violet in 3% KOH, 4 sterigmata.

Basidiospores 4.4-5.6 µm long in lateral and frontal face (mean value 4.84 µm, n=30), 3.2-3.8 µm width in lateral face (mean value 3.4 µm, n=30), ellipsoid frontal and lateral faces, verruculose, yellowish brown in distilled water, yellowish brown or mostly violet in 3% KOH but this colour can fade under the cover glass.

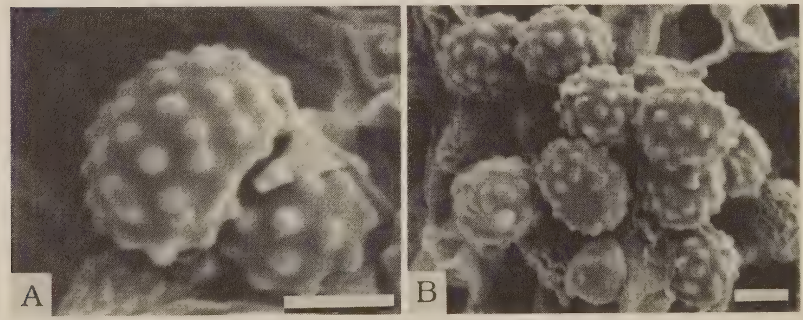


Fig. 1. SEM of basidiospores of *Amaurodon hydnoides* (isotype in TAA). - A: Lateral face. - B: Different faces, nearly frontal face in the center. Bar = 2 µm.

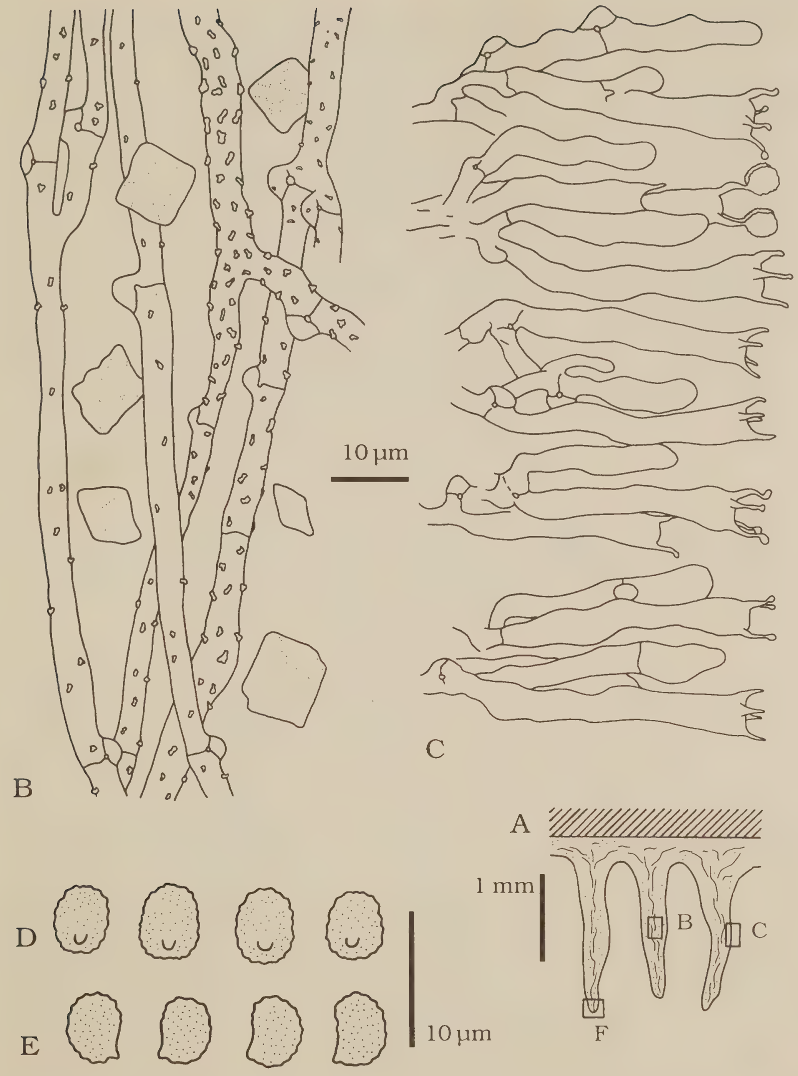
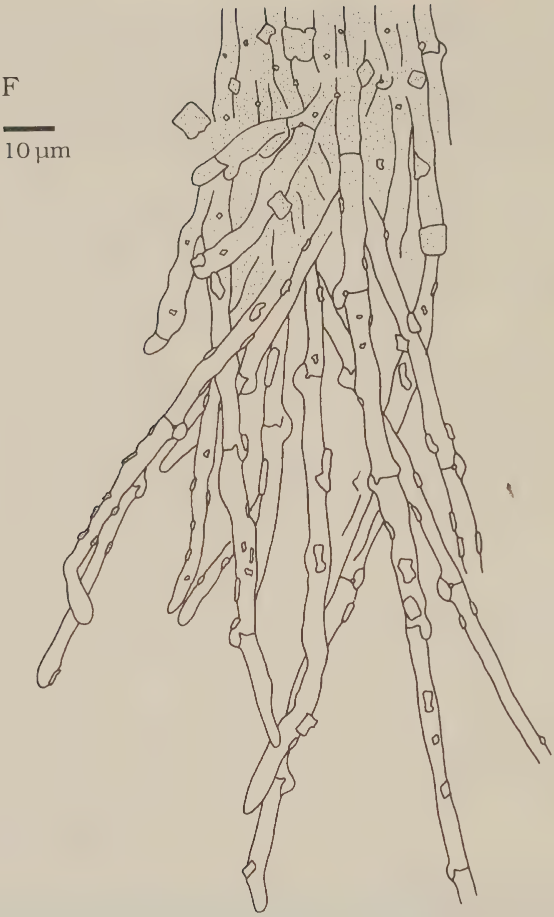


Fig. 2. *Amaurodon hydnoides* (Ryvarden 37576, isotype in TAA). - A: Section through basidiocarp showing positions of sections B, C and F. - B: Hyphae from the central part of a tooth. - C: Basidia. - D: Basidiospores in frontal face. - E: Basidiospores in lateral face. - F: Section through the apex of tooth (see next page).



Discussion

Kõljalg and Larsson (Kõljalg, 1996) emended *Amaurodon* to include six species which earlier were placed in Corticiaceae and Thelephoraceae. *A. hydnoides* is probably related to the type species of this genus *A. viridis*. Both occur on dead wood, and their hymenophore is bluish when fresh, yellowish-green when dry. The latter colour is present in all other species of *Amaurodon* as well but absent in other probably closely related genera of Thelephoraceae and Corticiaceae. *A. viridis* has smooth, warted or hydnoid hymenophore though never so strongly hydnoid like in *A. hydnoides* which has teeth up to 2 mm long. The two species are also similar microscopically and differ mainly by two characters. *A. viridis* has spores with always nearly globose frontal and lateral face (Kõljalg, 1996; Larsen, 1974) while the spores of *A. hydnoides* have ellipsoid frontal and lateral face (Figs. 1 and 2). The same shape of spores, viz. ellipsoid frontal and lateral face, is also present in *A. mustialaënsis* but the spores of that species are smooth (Gilbertson, 1974; Ginns, 1989). *A. hydnoides* differs from *A. viridis* also by its encrusted subicular and tramal hyphae, as well as by high amount of large crystals associated with tramal hyphae. *A. viridis* is the most common species of the genus with worldwide distribution in the temperate regions while *A. hydnoides* has been found only once. All other five species of *Amaurodon* have one or more characters which separate them clearly from our species.

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STRIOSPHAEROPSIS MIRABILIS ANAM. GEN. ET SP. NOV., A NEW COELOMYCETE ISOLATED FROM SOIL IN PAPUA NEW GUINEA

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ABSTRACT

A new generic name, *Striosphaeropsis* is proposed to accommodate an undescribed coelomycete, *S. mirabilis*, isolated from a soil in Papua New Guinea. Conidiomata are pycnidioid without ostioles and conidiogenesis is phialidic. Mature conidia are one-celled, brown, with an unusual ornamentation of continuous and discontinuous striae. Cultural characters are described. Its relationship to the coelomycete genera *Coniothyrium*, *Microsphaeropsis* and *Coniella* is discussed.

INTRODUCTION

During the last of four recent expeditions to Papua New Guinea, our collegue A. Aptroot collected thousands of plant and soil samples. He screened this material in collaboration with A. van Iperen for fungal diversity. From one of the soil samples, taken from dry forest remnants, a coelomycete was isolated characterized by pycnidioid conidiomata, and pigmented conidia developing an unusual ornamentation of the wall. Since no currently accepted genus is considered appropriate, a new generic name is proposed for this fungus.

METHODS

The fungus was isolated with a standard dilution plate method, using oatmeal and Czapek agars. Cultures on oatmeal (OA), malt extract (3 % MEA, Oxoid), and cornmeal (CMA) agars were incubated in the laboratory under diffuse daylight (19–21° C). Colour terminology according to Rayner (1970) is used.

For low-temperature SEM, conidial masses taken from cultures on oatmeal agar (4 weeks) were smeared on a stub coated with Tissue Tek mounting medium (Miles Scientific). Samples were frozen in slushed nitrogen in a Hexland CT1000A cryo system, sputtered with gold at –170° C for 3–4 minutes. After transfer to the cold stage (T = –140°) of a Jeol 840A scanning electron microscope specimens were observed and photographed at 7 kV.

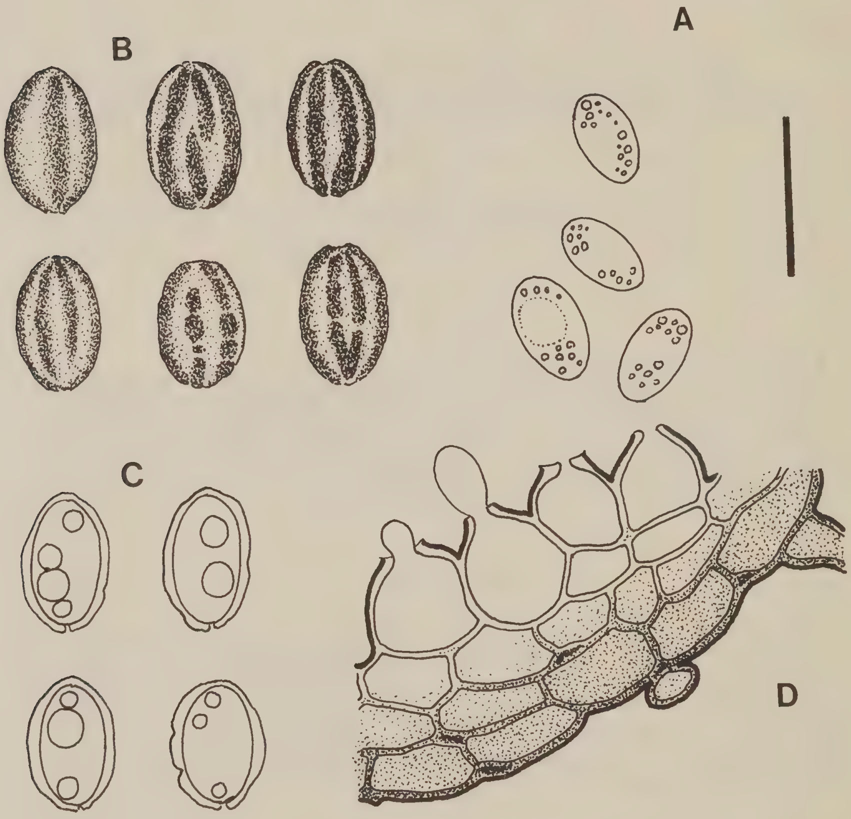


Fig. 1. *Striosphaeropsis mirabilis* (Holotype, CBS) Bar = 10 μm. A. Conidia just after liberation. B. Conidia in surface view. C. Conidia in cross view. D. Section through conidiomatal wall with conidiogenous cells.

RESULTS

Striosphaeropsis Verkley & van der Aa, anam. gen. nov.

> Conidiomata pycnidioidea, globosa, fusca vel atra, singularia vel confluentia cavitatibus concrescentibus, glabra, ostiolis carentia, cellulis superioribus dehiscentia. Parietes e textura angulari tenuitunicata compositi, cellulis exterioribus brunneis et interioribus hyalinis. Cellulae conidiogenae discretae, determinatae, undique e cellulis interioribus exorientes, hyalinae, doliiformes vel late subglobosae, phialidicae. Conidia ellipsoidea vel late fusiformia, continua, tempore liberationis hyalina glabra, deinde pallide olivaceo-brunnea, striis longitudinalibus continuis vel discontinuis rubro-brunneis vel purpureo-brunneis ornata, ad basim poris angusto.
>
> SPECIES TYPICA. *Striosphaeropsis mirabilis* Verkley & van der Aa.

Conidiomata pynidioid, globose, brown to black, single or confluent with merging cavities, glabrous, ostioles absent, dehiscing by dissolution of upper cells of the thin conidiomatal wall. *Conidiomatal walls* of thin-walled textura angularis, outer cells brown, inner cells hyaline. *Conidiogenous cells* discrete, determinate, formed from the inner cells all over the conidiomatal wall, hyaline, doliiform to broadly subglobose, phialidic. *Conidia* ellipsoid to broadly fusiform, continuous, hyaline and smooth when liberated, soon becoming pale olivaceous-brown and ornamented with longitudinal continuous or discontinuous, reddish brown or purplish brown striae, with a narrow pore at the base.
TYPE SPECIES. *Striosphaeropsis mirabilis* Verkley & van der Aa.

Striosphaeropsis mirabilis Verkley & van der Aa, sp. nov.

> Conidiomata superficialia vel in agaro immersa, globosa, primum pallide olivacea, deinde fusca vel atra, glabra, 75–150 (-300) μm diametro. Parietes tenues, e tribus vel quatuor stratis cellularum tenuitunicatarum compositi, cellulis exterioribus brunneis, materia atrobrunnea interspersis, cellulis interioribus hyalinis. Exsudatum conidiorum anthracinum. Cellulae conidiogenae determinatae, hyalinae, doliiformes vel subglobosae, phialidicae, 5.0–8.0 × 6.0–8.0 μm, tunica saepe sursum periclinaliter incrassata, collulum si adest minutum. Conidia ellipsoidea vel late fusiformia, interdum obovata, matura pallide olivaceo-brunnea et 5–9 striis longitudinalibus ornata, continuis vel discontinuis rubro-brunneis vel purpureo-brunneis 0.5 μm altis, ad vel prope basim apicemque conjungentes ornata, 6.3–9.0 (7.8±0.6 μm) × 4.5–6.0 μm (5.2±0.3 μm), bi vel triguttulata.

HOLOTYPE. Ex soil sample A. Aptroot s.n., X.1995, in dry forest remnants, Papua New Guinea, Central Province, Varirata National Park near Port Moresby; dried culture on oatmeal agar, *Herb. G. Verkley 407* (Holotype, CBS); living culture CBS 483.97.

Conidiomata superficial or immersed in the agar, globose, initially pale olivaceous, later brown to black, glabrous, 75–150 (-300) μm diameter. *Conidiomatal* *walls* thin, composed of three or four layers of thin-walled angular cells, outer cells brown with dark brown intercellular deposits, inner cells hyaline. Conidial exudate shiny black. *Conidiogenous cells* determinate, hyaline, doliiform to subglobose, phialidic, 5.0–8.0 × 6.0–8.0 μm, often with a periclinal wall thickening, collarette, if present, minute. *Conidia* ellipsoid to broadly fusiform, occasionally obovate, continuous, hyaline and smooth when liberated, but soon becoming pale olivaceous-brown, ornamented with 5 to 9 longitudinal continuous or discontinuous, reddish brown or lilac-brown striae, up to 0.5 μm high, fusing at or near the conidial apex and base, with a narrow pore at the base, measuring 6.3–9.0 (7.8±0.6 μm) × 4.5–6.0 μm (5.2±0.3 μm) (N=50), usually with 2–3 guttules.

Cultural characters. Colonies on MEA (3%, Oxoid) reaching a diameter of 70 mm after 14 d, Greenish glaucous, with even, Buff margin, and a low but dense mat of woolly, white to greyish aerial mycelium. Irregularly branching bundles of concolorous hyphae radiate into a Buff margin. Reverse Sepia. Conidiomata up to 150 μm in diameter, scattered throughout colony. Older cultures mostly covered by adpressed Smoke grey aerial mycelium, with some scattered circular areas of dense, pure white adpressed aerial mycelium.

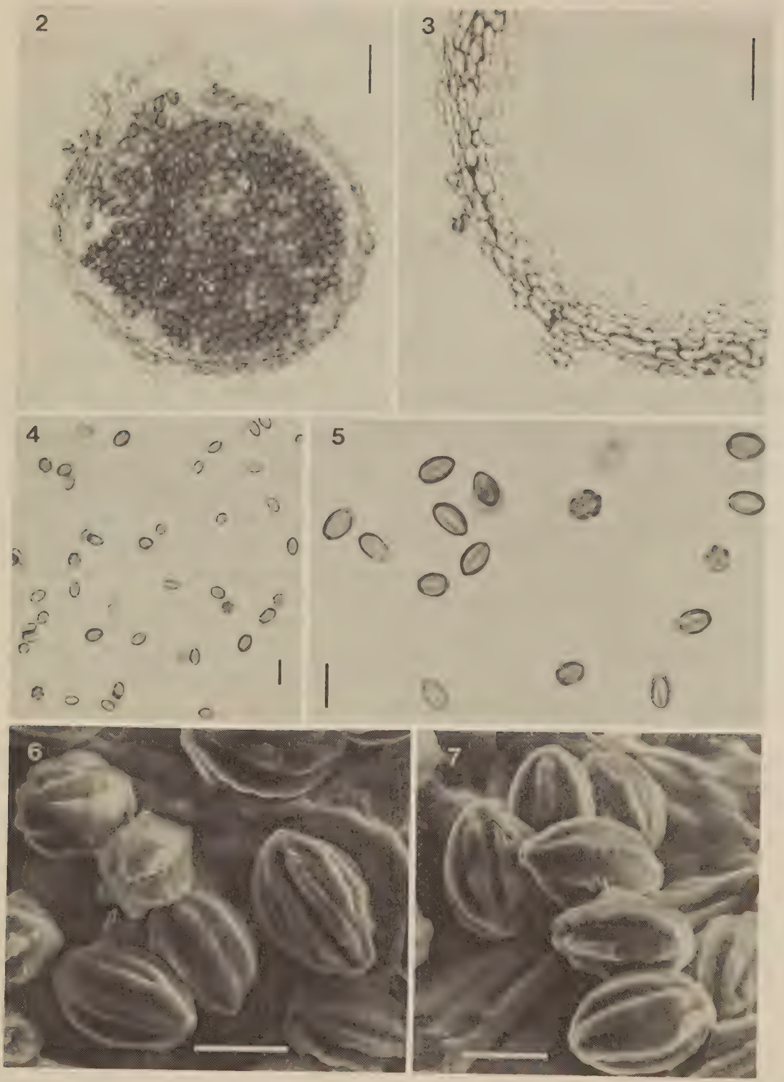
Colonies on OA reaching a diameter of 75 mm after 14 d, Pale luteous to Luteous after 14 d, with an even, colourless margin and scanty, white aerial mycelium. Conidiomata as on MEA, but often more densely arranged in a broad concentric zone. Reverse concolorous. After 3 weeks pigment in centre fades, while outer zone darkens, becoming brown to olivaceous.

Colonies on CMA as on OA, but more intensely coloured after 14 d. Conidiomata up to 300 μm in diameter, scattered, but also in rows radiating from the centre.

No significant differences were observed in conidial measurements on different media. Pigments produced did not react on addition of a drop of 1 N NaOH.

DISCUSSION

Pycnidial coelomycetes with relatively small and pigmented conidia are traditionally described in the genus *Coniothyrium* Corda. Petrak & Sydow (1927) and Wollenweber & Hochapfel (1937) already pointed out that the genus is very heterogeneous. After the introduction of conidiogenesis as a character at the genus level, several old genera were re-defined. *Coniothyrium* Corda was restricted to species with holoblastic, annellidic conidiogenous cells, i.e., cells proliferating percurrently after secession of each conidium, the conidia seceding at progressive levels and leaving a series of annellations. Pycnidial species with 'phialidic' conidiogenous cells, i.e., cells from which conidia secede at the same level, could be reclassified in *Microsphaeropsis* Höhn., and stromatic ones in *Cyclothyrium* Petrak (including *Cytoplea* Bizz. & Sacc. pr. p.; Morgan-Jones, 1974; Jones, 1976; Sutton, 1977; 1980). *Coniella* Höhn. accommodates species with phialidic conidiogenous cells, exclusively formed on a pulvinate area arising from the base of the conidiomatal cavity. Most of the species in these genera have smooth conidia but both *Coniothyrium* and *Microsphaeropsis* also contain a restricted number of species with verrucose or more roughly warted conidia



Figs 2–7. *Striosphaeropsis mirabilis* (CBS 483.97). Fig. 2. Cross section through conidioma filled with mature conidia. Bar = 20 μm. Fig. 3. Cross section through part of wall of an old, empty conidioma. Bar = 20 μm. Figs 4, 5. Mature conidia in water. Bar = 10 μm. Figs 6, 7. Cryo-SEM of conidia. Bars = 5 μm. Fig. 6. Arrow, conidial apex. Fig. 7. Arrow, conidial base with minute pore.

(Punithalingam & Jones, 1970; Sutton, 1980; Morgan Jones & White, 1987), but none with an ornamentation as described here in *Striosphaeropsis*.

Although conidiogenesis agrees with that in *Microsphaeropsis*, the new fungus cannot be placed in that genus for two reasons. Firstly, the type species of *Microsphaeropsis*, *M. olivacea* (Bonord.) Höhn., is characterized by ostiolate pycnidia, smooth, thin-walled conidia, and cultures with pigments reacting on addition of NaOH. Secondly, the verrucose to warted ornamentations described in certain species of *Microsphaeropsis* consist of superficial, most darkly pigmented material. The striae on the large, one-septate conidia of *Lasiodiplodia theobromae* (Pat.) Griff. & Maubl, also consist of minute warts, densely arranged in longitudinal bands over the wall surface (Punithalingam, 1969). In contrast, the stout striae of *Striosphaeropsis* consist of masses of moderately pigmented material which form an integrated part of the conidial wall. Therefore a new generic name is proposed, primarily defined by the non-ostiolate, pycnidioid conidiomata, and the exclusive striation of the one-celled conidia.

Zambettakis (1954) proposed the generic names *Strionemadiplodia* and *Striodiplodia* for species with brown, constantly two-celled, striate conidia. Sutton (1977) noted, that these generic names and combinations were invalidly published. The type species of *Striodiplodia* Zambettakis, *Diplodia agaves* Niessl, is the only one with conidia comparable in size to those of *Striosphaeropsis* (6–9 × 4 μm; Zambettakis, 1954). This old name refers to a different fungus, as could be confirmed by study of an isotype at CBS in Rabenhorst, Fungi europaei exsiccati Ed. 2 nr. 2434 (sub *Diplodia agaves* Kurz), on leaves of *Agave* in India, which contains dark-walled pycnidia and thick-walled, 2–3-celled conidia, constricted around the septa, and with fine superficial, discontinuous, darkly pigmented striae. Sutton (1977) suggested that the genus *Striodiplodia* Zambettakis is probably synonymous with *Lasiodiplodia* Ell. & Ev.
The type of conidial ornamentation in *Striosphaeropsis* is very rare in deuteromycetes. A similar ornamentation occurs in conidia of the hyphomycete *Sagenomella striatispora* (Onions & Barrow) W. Gams (Gams, 1978).

Striosphaeropsis mirabilis was isolated only once from soil, and new records of the fungus are needed to elucidate its ecology.

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MORE CONIDIAL FUNGI FROM LA GOMERA, CANARY ISLANDS, SPAIN

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ABSTRACT

Cheiromoniliophora gracilis var. hispanica var. nov. and *Mirandina speciosa anam. sp. nov.*, found on litter in La Gomera (Canary Islands, Spain) are described and illustrated. Other interesting species are reported for the first time in Spain.

Keywords: *Cheiromoniliophora, Mirandina, Dictyosporium, Endophragmiella,* tropical fungi, hyphomycetes, systematics, litter, Spain

RESUMEN

Se describen e ilustran *Cheiromoniliophora gracilis* Castañeda Ruíz, Guarro *et* Cano *var. hispanica var. nov.* y *Mirandina speciosa anam. sp. nov.* aisladas a partir de hojarasca. Se citan por primera vez para España otras especies interesantes.

Palabras clave: *Cheiromoniliophora, Mirandina, Dictyosporium, Endophragmiella,* hongos tropicales, hifomicetes, sistemática, hojarasca, España

The Canary Islands are the Southernmost part of Spain. They are near the North West African coast and due to the influence of tropical African winds they have a rich flora characterized by well preserved forests of ***Laurus canariensis*** (laurisilva). This enhances the proliferation of a large number of fungi. In a recent trip to La Gomera we collected numerous fungi, some of them described in a previous paper (Castañeda et al., 1996a). Other interesting species are included here.

Cheiromoniliophora gracilis Castañeda Ruíz, Guarro et Cano *var.* ***hispanica*** Castañeda Ruíz et Guarro, *var. nov.* Figs. 1,2

Ad fungus conidiales, hyphomycetes pertinens. Coloniae pilosae, amphigenae, olivaceae. Mycelium partim superficiale et partim in substrato immersum, ex hyphis septatis, ramosis, laevibus, hyalinis vel subhyalinis, 1.5 - 2.5 µm diam., compositum. Conidiophora conspicua, mononematosa, erecta, septata, perramosa, usque 350 µm alta, ad basim 4 - 6 µm crassa, cylindrica, levia, hyalina. Cellulae conidiogenae monoblasticae, raro polyblasticae, sympodiales, terminales et laterales, laeves, discretae, cylindricae, 9 - 20 x 3 - 3.5 µm. Conidia compacta, cheiroidea, interdum ellipsoidea, complanata, laevia vel verrucosa, sicca, pallide brunnea, 14 - 18 x 10 - 13 µm; ex 2 - 3 ramis parallelis, confertis, 2 - 4 septatis, composita. Ramis ex cellula basi deltatis oriundis. Teleomorphosis ignota.

Matrix: *In foliis dejectis Laurus canariensis*, El Cedro, Parque Nacional de Garajonay, La Gomera, *Hispania*. Leg. R. F. Castañeda et J. Guarro, 4-I-1995

Typus: INIFAT C95/20, Santiago de las Vegas, Ciudad de la Habana, Cuba.

Conidial fungi, hyphomycetes. Colonies hairy, amphigenous, olivaceous. Mycelium superficial and immersed. Hyphae septate, branched, smooth, hyaline to subhyaline, 1.5 - 2.5 µm diam. Conidiophores differentiated, mononematous, erect, septate, very branched, up to 350 µm tall, 4 - 6 µm wide at the base, cylindrical, smooth, hyaline. Conidiogenous cells monoblastic, rarely polyblastic, sympodial, terminal and lateral, smooth, discrete, cylindrical, 9 - 20 (25) x 3 - 3.5 µm. Conidia compact, cheiroid, sometimes ellipsoid, flattened, smooth to slightly verrucose, dry, pale brown, 14 - 18 x 8 - 13 µm, composed of 2 - 3 parallel, crowded, 2 - 4 septate arms, arising from a deltate basal cell, with a narrow and prominent basal scar. Teleomorph unknown.

Matrix: On rotten leaves of *Laurus canariensis*, El Cedro, Garajonay National Park, La Gomera, Canary Islands, Spain. R. F. Castañeda and J. Guarro, 4, January 1995.

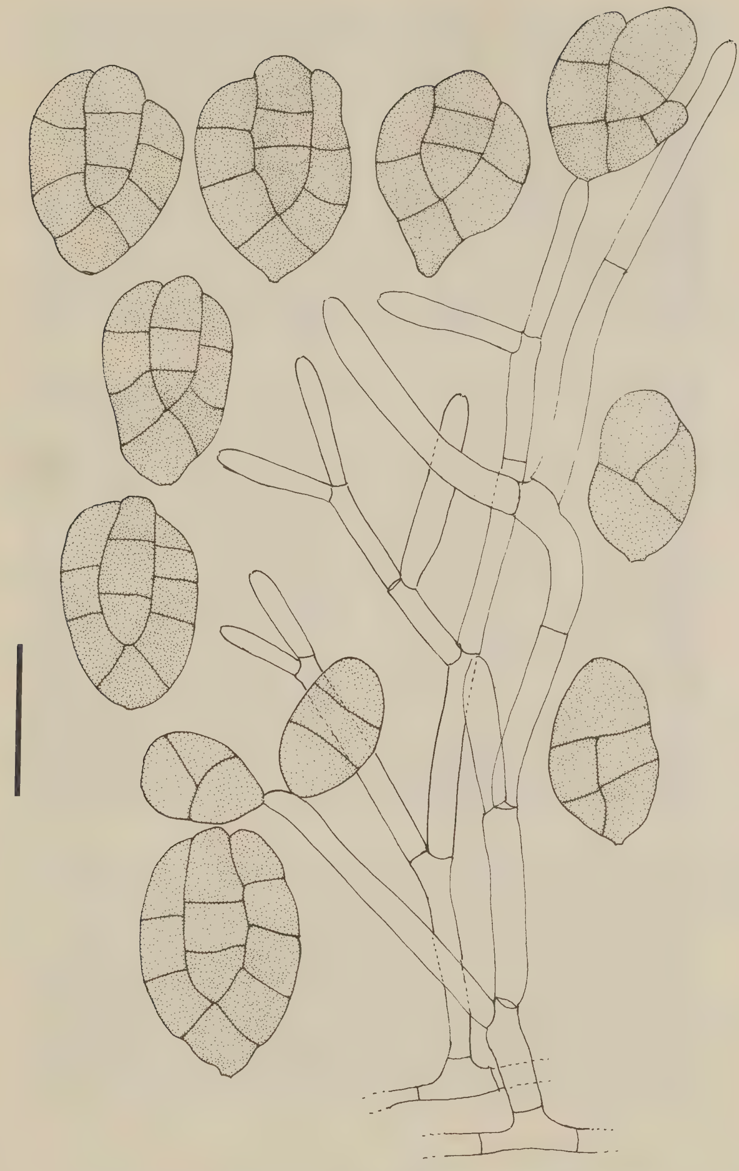

FIG.1.- ***Cheiromoniliophora gracilis*** var. ***hispanica*** (INIFAT C95/20). Conidiophores and conidia (bar = 10 μm).

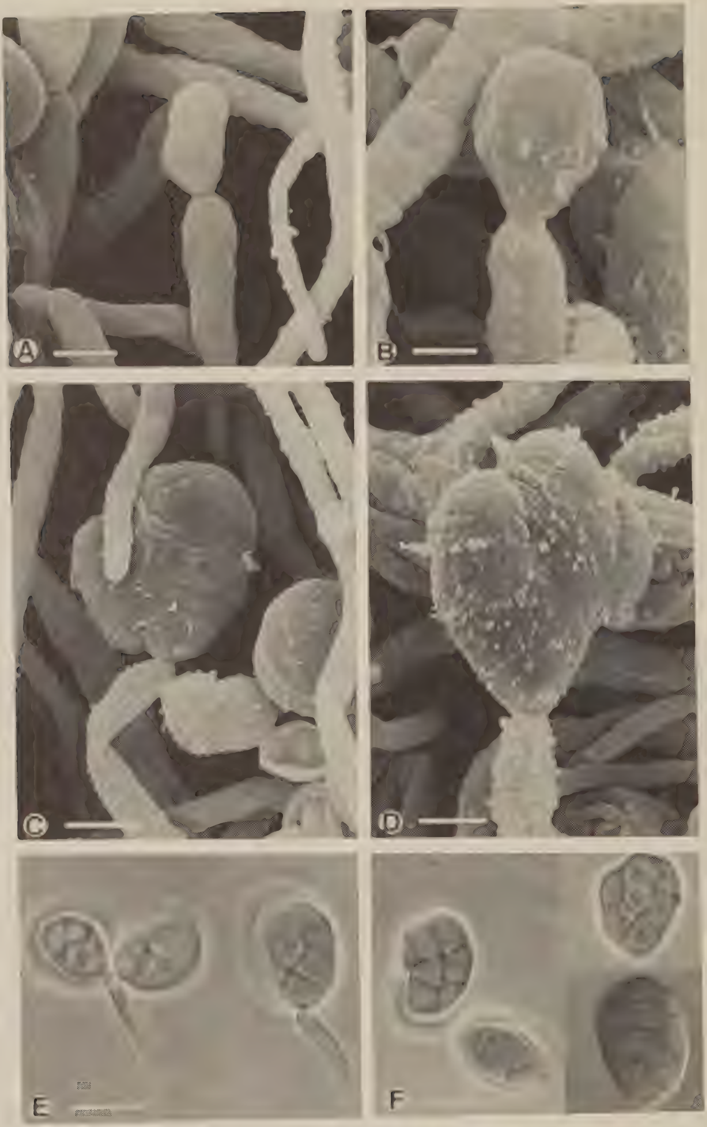

FIG.2 - ***Cheiromoniliophora gracilis*** var. ***hispanica*** (INIFAT C95/20). A,B - Different stages of conidium ontogeny (A, bar = 3 µm; B, bar = 2 µm; C, bar = 5 µm; D, bar = 3 µm). E, Conidia and conidiogenous cells (bar = 10 µm). F, Conidia (bar = 10 µm).

Type: INIFAT C95/20, Santiago de las Vegas, Ciudad de la Habana, Cuba.

Other specimens examined: MUCL 40018, on rotten leaf of *Quercus ilex*, La Musara, Tarragona, Spain. R.F. Castañeda, 9 July, 1996. MUCL 40015, on twig, La Musara, Tarragona, Spain. R.F. Castañeda, 9 July, 1996.

Cultures deposited: INIFAT C95/20 = CBS 471.95 = IMI 367535; MUCL 39933.

Cheiromoniliophora gracilis var. *hispanica* resembles *Ch. gracilis* Castañeda, Guarro et Cano var. *gracilis* (Castañeda *et al.*, 1996 b) in the pigmentation and shape of the conidia, but the conidiophores in the latter are moniliform with globose to clavate, echinulate conidia

This fungus is similar to *Kamatia indica* Rao & Subhedar (1976), a synonym of *Pseudodictyosporium wauense* Matsushima (1971a). But this taxon can be easily differentiated from *Ch. gracilis* var. *hispanica* by its pigmented conidiophores.

Mirandina speciosa Castañeda Ruíz, Guarro *et* Cano, *anam. sp. nov.*

Figs 3,4 A-C

Etymol.: *speciosa* Latin for beautiful.

Ad fungus conidiales, hyphomycetes pertinens. Coloniae effusae, pilosae, brunneae. Mycelium partim superficiale et partim in substrato immersum, ex hyphis septatis, ramosis, laevibus, brunneis, 1.5 - 3.5 µm diam. Conidiophora conspicua, mononematosa, erecta, recta vel flexuosa, cylindrica ad basim et ad apicem leviter geniculata, 5 - 10 septata, levia, ad basim brunnea, ad apicem subhyalina, 130 - 320 x (3) 4 - 7 µm. Cellulae conidiogenae incorporatae, polyblasticae, sympodiales, subhyalinae, denticulatae, cum denticulis inconspicuis. Conidia fusiformia vel falcata, non-septata, obtusa vel rostrata, ad apicem leviter uncinata, attenuata, ad basim truncata, 9 - 12 x 0.5 - 1 µm, laevia, hyalina, sicca. Teleomorphosis ignota.

Matrix: *In ramuncule emortui non determinato*, El Cedro, Parque Nacional Garajonay, La Gomera, *Hispania*. Leg. R. F. Castañeda et J. Guarro, 4 - I - 1995.

Typus: INIFAT C95/31, Santiago de las Vegas, Ciudad de La Habana, Cuba.

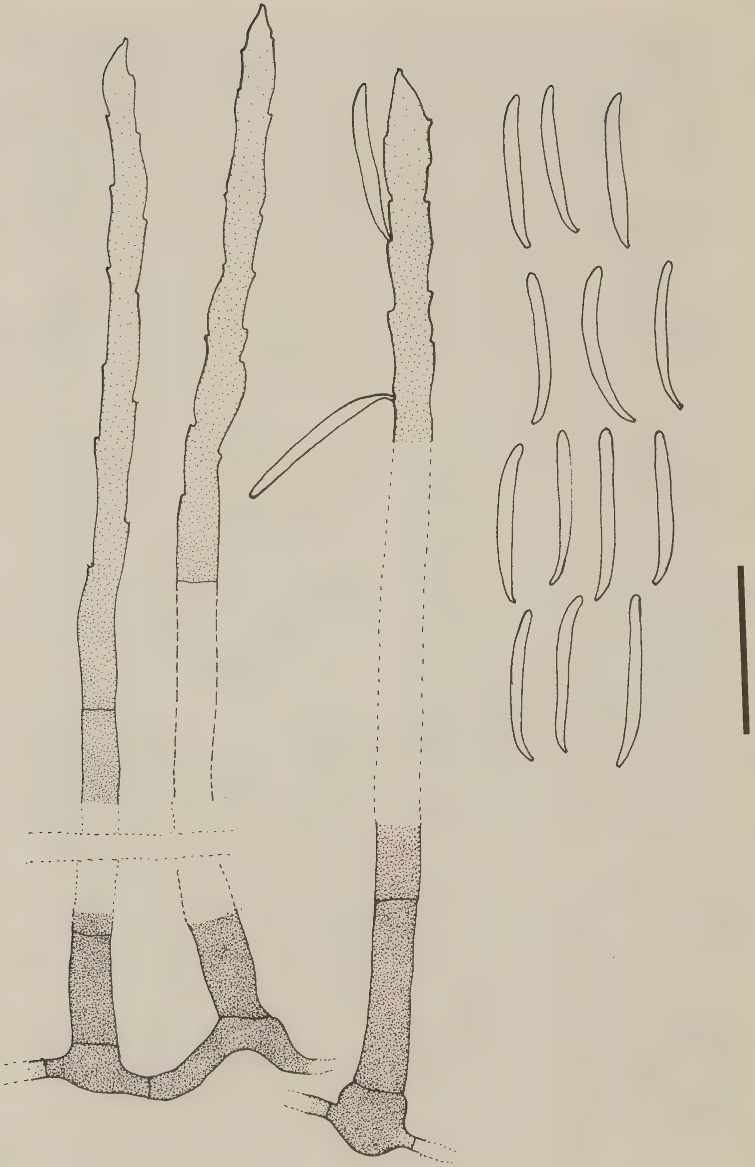

FIG.3.- ***Mirandina speciosa*** (INIFAT C95/31). Conidiophores and conidia (bar = 10 µm).

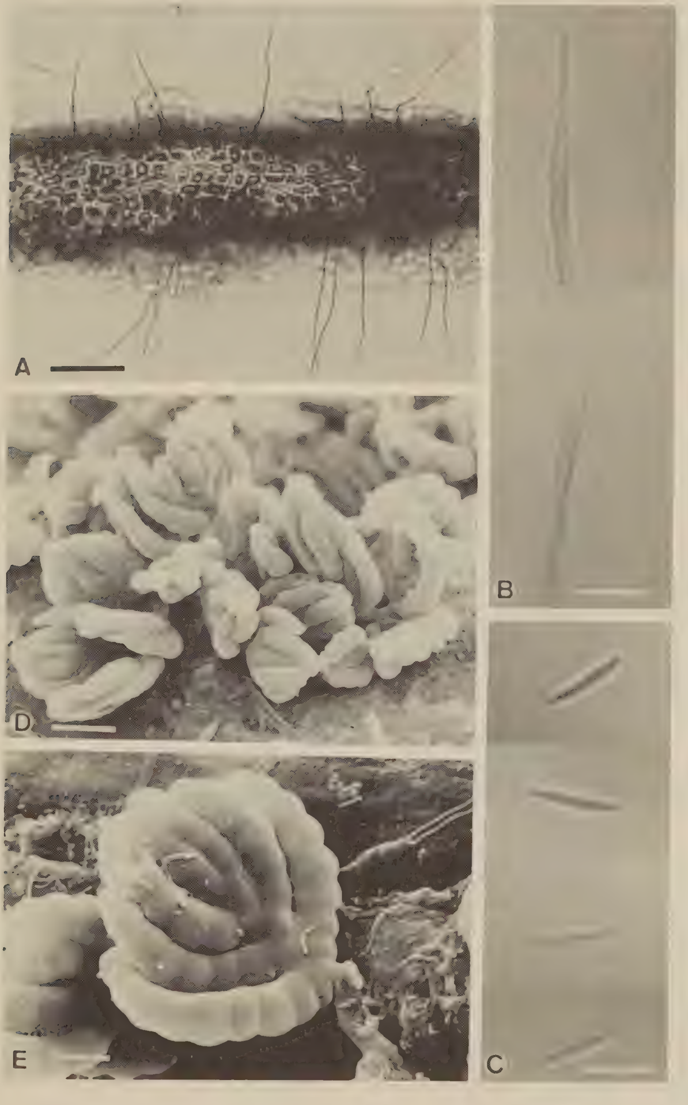

FIG.4.- ***Mirandina speciosa*** (INIFAT C95/31). A, Conidiophores on natural substrate (bar = 100 µm). B, Conidia and conidiogenous cells (bar = 10 µm). C, Conidia (bar = 10 µm).
Dictyosporium bulbosum (INIFAT C95/34). D,E, Conidia (D, bar = 10 µm; E, bar = 5 µm).

Conidial fungi, hyphomycetes. Colonies hairy, spreading, brown. Mycelium superficial and immersed; hyphae septate, branched, smooth, brown. 1.5 - 3.5 µm diam. Conidiophores differentiated, mononematous, erect, straight or flexuous, cylindrical at the base, slightly geniculate at the apex, 5 - 10 septate, 130 - 320 x (3) 4 - 7 µm, smooth-walled, brown at the base, subhyaline at the apex. Conidiogenous cells polyblastic, sympodial, subhyaline, denticulate, with inconspicuous denticles, integrated. Conidia fusiform to falcate, non-septate, truncate at the base, slightly uncinate at the apex, 9 - 12 x 0.5 - 1 µm, smooth, dry, hyaline. Teleomorph unknown.

Matrix: On twig of unidentified plant, El Cedro, Garajonay National Park, La Gomera, Spain. R. F. Castañeda and J. Guarro, 4, Jan, 1995.

Type: INIFAT C95/31, Santiago de las Vegas, Ciudad de las Habana, Cuba.

The genus *Mirandina* Arnaud (Matsushima, 1975) is morphologically related to *Dactylaria* Sacc. Both genera have polyblastic conidiogenous cells with sympodial proliferation and conspicuous denticles, although in some species of *Mirandina* these are often reduced to flat scars (Hoog, 1985).

Among previously described species of *Mirandina* with non-septate conidia, *M. arnaudii* P. M. Kirk (1986) and *M. fragilis* Castañeda Ruíz & Kendrick (1991) have conidial development similar to that of *M. speciosa*, but the former has filiform, conidia 18 - 24 (26) x 1 - 1.5 µm and the second has cylindrical to filiform, sometimes fusiform, conidia 13 - 17 x 1 - 1.5 µm. Several scolecosporous species have been published by Matsushima (1971b, 1975, 1980, 1983), but they are very different from *M. speciosa.*

Dictyosporium bulbosum Tzean & Chen, Mycol. Res. **92**:500 (1989).
Fig.4 D,E

Colonies powdery olivaceous to brown, amphigenous. Conidiophores inconspicuous, mononematous, irregularly branched, smooth, pale brown. Conidia solitary, palmate to cheiroid, pale brown to brown, flattened, 25-32 x 15 - 30 µm; arms 3 - 6 (7) in number, parallel, incurved, 14 - 25 x 3 - 5 µm, brown, 4 - 8 septate, a hyaline appendage sometimes arising from the apex of the outer arms.

Specimen examined: INIFAT C95/34, on unidentified rotten leaves, La Gomera, Garajonay National Park, Spain. R. F. Castañeda and J. Guarro, 3, January 1995.

Cultures deposited: INIFAT C95/34, CBS 313.95.

Endophragmiella lignicola S.J. Hughes, N. Z. Jl. Bot. **17**:151 (1979)
= *Acrophragmis levispora* Gamundi & Arambarri, Darwiniana **22**:204 (1979)
Fig.5

Colonies spreading, hypophyllous, brown. Conidiophores differentiated, mononematous, erect, with numerous pseudopercurrent regenerations. Conidia ellipsoid to obclavate, 2-septate, central cell inflated, smooth, rarely verruculose, 13 - 18 x 5 - 6 µm, dry, subhyaline with the central cells dark brown.

Specimen examined: INIFAT C95/29-4, on rotten leaves, La Gomera, Garajonay National Park, Spain. R. F. Castañeda and J. Guarro, 3, January 1995.

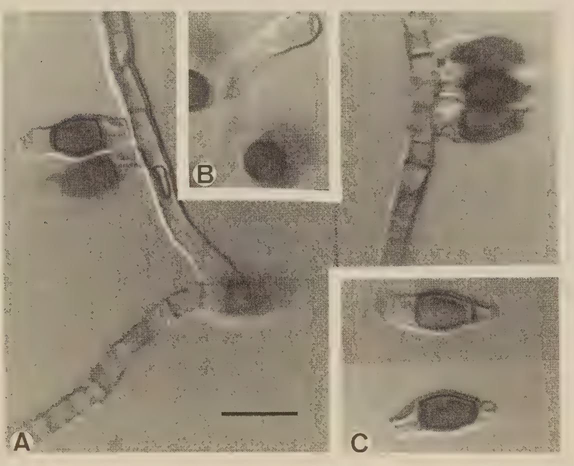

FIG.5.- ***Endophragmiella lignicola*** (INIFAT C95/29-4). A, Conidia and conidiogenous cells. B, Young conidium. C, Mature conidia (bar = 10 µm).

Oidiodendron griseum Robak, apud Melin & Nannf. in Svenska Skogs For. Tidskr. **3/4**: 440 (1934).

Specimen examined: INIFAT C95/49-1 on unidentified rotten leaves, La Gomera, El Cedro, Garajonay National Park, Spain. R. F. Castañeda Ruíz and J. Guarro, 4, January 1995.

Cultures deposited: INIFAT C95/49-1, CBS 316.95.

Oidiodendron tenuissimum (Peck) S.J. Hughes, Can. J. Bot. **36**:790 (1958)

Specimen examined: INIFAT C95/58 on rotten leaves, Garajonay National Park, La Gomera, Spain. R. F. Castañeda and J. Guarro, 4, January 1995.

Cultures deposited: INIFAT C95/58, CBS 315.95.

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TAXONOMICAL STUDIES ON USTILAGINALES. XVI. *

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ABSTRACT

The smut fungi of the genera *Apluda, Boissiera, Brachiaria, Melinis* (incl. *Rhynchelytrum), Vetiveria* (Gramineae), *Lepidosperma* (Cyperaceae), *Melanotaenium* species of *Ischaemum*, and some other smuts were studied.

NEW SPECIES proposed: *Macalpinomyces nigritanae* K. Vánky (type on *Vetiveria nigritana*, Sierra Leone), *Melanotaenium indicum* K. Vánky, M. S. Patil & N. D. Sharma (type on *Ischaemum indicum*, India); *Sporisorium iseilematis-prostrati* K. Vánky (type on *Iseilema prostratum*, India); *Tolyposporium megaglomerulosum* K. Vánky (type on *Lepidosperma gunnii*, Australia), and *Ustilago boissierae* K. Vánky (type on *Boissiera squarrosa*, Pakistan).

NEW NAME proposed: *Sporisorium mishrae* K. Vánky, replacing *Sorosporium apludae* J. N. Mishra (not *Sporisorium apludae* (H. & P. Sydow) L. Guo; type on *Apluda varia*, India).

NEW COMBINATIONS proposed: *Sporisorium apludae-aristatae* (B. V. Patil & Thirumalachar) K. Vánky, based on *Sorosporium apludae-aristatae* (type on *Apluda aristata*); *Sporisorium chudaei* (Hariot & Patouillard) K. Vánky, based on *Sphacelotheca chudaei* (type on "*Panicum turgidum*" = misnamed *Vetiveria nigritana*); *Sporisorium melinis* (Zundel) K. Vánky, based on *Cintractia melinis* (type on *Melinis tenuinervis*); *Sporisorium ovarium* (Griffiths) K. Vánky, based on *Sorosporium ovarium* (lectotype on *Panicum caespitosum* = *Brachiaria reptans*); *Sporisorium serratum* (L. Ling) K. Vánky, based on *Sphacelotheca serrata* (type on *Brachiaria serrata*); *Tilletia brachiariae* (Pavgi & Thirumalachar) K. Vánky, based on *Tilletia pulcherrima* Ellis & Gall. ex G. P. Clinton var. *brachiariae* (type on *Brachiaria distachya*).

SYNONYMS: *Melanotaenium echinochloae* M. S. Patil (type on "*Echinochloa* sp." = misnamed *Brachiaria distachya*) is *Melanotaenium brachiariae* Viégas (type on *Brachiaria plantaginea*); *Sorosporium brachiariae-ramosae* Ramakrishnan (type on *Brachiaria ramosa*) is *Sporisorium ovarium*

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* Part 135 in the series "Studies in Heterobasidiomycetes" from the Botanical Institute, University of Tübingen.

(Griffiths) K. Vánky (type on *Brachiaria ramosa*); *Sphacelotheca apludae* Pavgi & Mundkur (type on *Apluda varia* var. *aristata* = *A. mutica*) is *Sporisorium apludae* (H. & P. Sydow) L. Guo (type on *Apluda mutica* var. *aristata* = *A. mutica*); *Tolyposporella brachiariae* Thirum. & Mundkur (type on *Brachiaria distachya*) is *Melanotaenium brachiariae* Viégas (type on *Brachiaria plantaginea*); *Ustilago rhynchelytri* L. Ling (type on *Rhynchelytrum repens* = *Melinis repens*) is *Sporisorium melinis* (Zundel) K. Vánky (type on *Melinis tenuinervis* = *M. minutiflora*); *Ustilago sorghi-stipoidei* L. Ling (type on *Sorghum stipoideum*) is *Ustilago ewartii* McAlpine (type on *Sarga stipoidea* = *Sorghum stipoideum*).

The HOST PLANT of *Ustilago dregeana* Tul. is a species of *Danthonia* s. lat.

EXCLUDED SPECIES: *Ustilago lupini* Camara is a myxomycete.

THE SMUT FUNGI OF *APLUDA* (GRAMINEAE).

The monotypic genus *Apluda* from tropical Asia belongs to the subfam. Panicoideae, tribe Andropogoneae, subtribe Ischaeminae (Clayton & Renvoize, 1986). At least seven smut fungi have been published on *Apluda mutica* L. (including *A. aristata* L., *A. varia* Hack., and its var. *aristata* (L.) Hack.). These are: **1**. *Ustilago apludae* H. & P. Sydow, **2**. *Sphacelotheca apludae* Pavgi & Mundkur, **3**. *Tilletia apludae* Thirum. & Mishra, **4**. *Sorosporium apludae* J. N. Mishra, **5**. *Melanotaenium apludae* Thirum. & Srinivasan, **6**. *Sorosporium apludae-aristatae* B. V. Patil & Thirum., and **7**. *Sphacelotheca apludae-aristatae* Rao & Neema.

Vánky (1996:104) demonstrated that the host plant of the type of *Sphacelotheca apludae-aristatae* Rao & Neema is not "*Apluda aristata* L." but *Iseilema laxum* Hackel, and its smut is *Sporisorium iseilematis* (H. & P. Sydow & Butler) K. Vánky.

E. J. Butler collected a smut fungus in India which was published (H. & P. Sydow & Butler, 1907:485) and also distributed (in Sydow, Ust. No. 377) under the name of *Ustilago arundinellae* Bref. on *Arundinella setosa* Trin. Pavgi & Mundkur (1949:110) demonstrated that "both names are incorrect", the host plant being *Apluda varia.* Its smut was described as *Sphacelotheca apludae* Pavgi & Mundkur. However, this smut corresponds with the description of *Ustilago apludae* H. & P. Sydow (= *Sporisorium apludae*), and is considered here as its synonym.

Some of the *Apluda* smuts show characters of a *Sporisorium*. The following five smut fungi and their synonyms could be recognised:

1. ***Sporisorium apludae*** (H. & P. Sydow) L. Guo, 1990:76.

Ustilago apludae H. & P. Sydow, 1919:141. — *Sphacelotheca apludae* (H. & P. Sydow) Zundel, 1953:81, later homonym, not Pavgi & Mundkur, 1949. — Type on *Apluda mutica* L. var. *aristata* Hack. (= *A. mutica* L.), China, Kwangtung Prov., Henng Shan, 27.V.1919, O. A. Reinking (no. 6820), BPI 157289!

Sphacelotheca apludae Pavgi & Mundkur, 1949:110. — Type on *Apluda varia* Hack var. *aristata* (L.) Hack. (*Apluda aristata* L., = *A. mutica* L.). India, Uttar

Pradesh, Kumaon Himalaya, Burma Gori, 24.VII.1907, E. J. Butler (724). Isotypes in Sydow, Ust. No. 377 (as *Ustilago arundinellae* Bref. on *Arundinella setosa* Trin.; HUV 1859!), and in Indian Ust. No. 13 (HUV 5761!).

Sori in all spikelets of an inflorescence, elongate, 5–7.5 mm long, covered by glumes and a leathery peridium which dehisces apically exposing a dark brown, powdery mass of spores surrounding a simple, 1–2 cm long columella with forked tip. Spores globose, ovoid, broadly ellipsoidal or subpolyhedral, 4–5.5 x 5–6.5(–7) µm in diameter, apparently smooth to very finely punctate, in SEM finely, moderately densely, low verruculose-echinulate. Sterile cells larger than the spores, 8–16 µm long, in small, irregular groups, subhyaline to tinted yellowish-brown, smooth, collapsed in old specimens.

2. ***Sporisorium mishrae*** K. Vánky, **nom. nov.**

Replaced name: *Sorosporium apludae* J. N. Mishra, Mycologia 48:875, 1956 (not *Sporisorium apludae* (H. & P. Sydow) L. Guo). — Type on *Apluda varia* Hack. (= *A. mutica* L.), India, Bihar, Netarhat, alt. 3000 ft., 30.XI.1955, coll. J. N. Mishra. Holotype HCIO 25282!, isotype BPI 179439!

Sori in the spikelets, grouped into witches' brooms from a few cm up to 25 cm or longer. The floral envelopes of infected spikelets leafy and much elongated. Sori long, cylindrical, with acute tip, 0.5–1.5 x 5–15 mm, covered by a leathery brown peridium which ruptures irregularly from the sides disclosing the agglutinated to powdery, blackish-brown mass of spore balls and spores surrounding a simple, long, central columella. Spore balls loose, many-spored, subglobose to elongated or irregular, 40–100(–120) x 50–150(–200) µm, reddish-brown. Outer spores globose, ellipsoidal, broadly subcuneate to slightly irregular, 7–10.5 x 8–12(–13) µm, dark reddish-brown; wall 1–1.5 µm thick, densely verruculose. Inner spores irregularly subpolyhedral, pale yellowish-brown, with thin (0.5–0.8 µm), apparently smooth to very finely punctate wall. Sterile cells between the spores not seen.

3. ***Sporisorium apludae-aristatae*** (B. V. Patil & Thirumalachar) K. Vánky, **comb. nov.**

Basionym: *Sorosporium apludae-aristatae* B. V. Patil & Thirumalachar, Sydowia 20:48, 1966(1968). — Type on *Apluda aristata* L. (= *A. mutica* L.), India, Maharashtra State, Nasik, Mangitungi, 10.XII.1961, B. V. Patil.

Sori in the ovaries and filaments of some or all spikelets in a few racemes of the inflorescence, cylindrical, 0.7–1.5 x 7–10 mm, partly hidden by the spatheole and floral envelopes, first covered by a yellowish-brown peridium which ruptures from its apex disclosing the granular-powdery mass of spores and a central, filiform columella. Spore balls subglobose, ovoid, ellipsoidal, elongated to irregular, 35–80 x 40–100(–110) µm, dark reddish-brown, many-spored, rather permanent. Spores subglobose, ellipsoidal, usually irregularly subpolyhedral, 7–10.5 x 8–12(–13) µm. Outer spores dark brown, densely, prominently echinulate on their free surface with spines up to 1–1.5 µm, verruculose on their contact sides; wall 0.8–1 µm thick. Inner spores pale yellowish-brown, smooth, thin-walled (ca. 0.5 µm). Sterile cells between the spore balls absent.

Type not seen. Description based on the original and on Vánky, Ust. exs. 916.

4. ***Tilletia apludae*** Thirumalachar & Mishra, 1953:81.

Type on *Apluda aristata* L. (= *A. mutica* L.), India, Bihar, Parasnath, 9.XII.1952, leg. J. N. Mishra (BPI 172380!).

Sori in scattered ovaries, inconspicuous, concealed by the enveloping glumes, becoming evident only after rupture of the sorus membrane revealing the black, powdery spore mass intermixed with immature spores and sterile cells. Mature spores variable in shape and size, globose, subglobose ovoid to slightly irregular, 15–36 x 18–40 µm, dark reddish- to blackish-brown, opaque; wall 3–4.5 µm thick, densely, finely to coarsely verrucose; warts 1–1.5 µm high, encased in a hyaline sheath. Spores often with a short, hyaline appendage. Sterile cells variable, globose, ellipsoidal to irregularly subpolyhedral, 13–32 x 14–40 µm, light brown; wall 1.5–3 µm thick, smooth.

Durán & Fischer (1961:117) considered *Tilletia apludae* to be a synonym of *T. vittata* (Berk.) Mundkur (type on *Oplismenus compositus* Beauv., Tribe Paniceae). However, in *T. vittata* the sori are considerably hypertrophied and the spores are much smaller (13–21 µm) than those of *T. apludae*.

5. ***Melanotaenium apludae*** Thirumalachar & Srinivasan, in Srinivasan & Thirumalachar, 1963(1964):21.

Type on *Apluda aristata* L. (= *A. mutica* L.), India, South India, Yercaud, 11.I.1957, leg. (?).

Sori in the leaves as discrete, linear or rectangular, dull grey, nonerumpent spots, 3–6 mm long and 1–4 mm wide often becoming irregular by confluence. Spores angular to subglobose, 7.5–15 µm, dark brown, thick-walled.

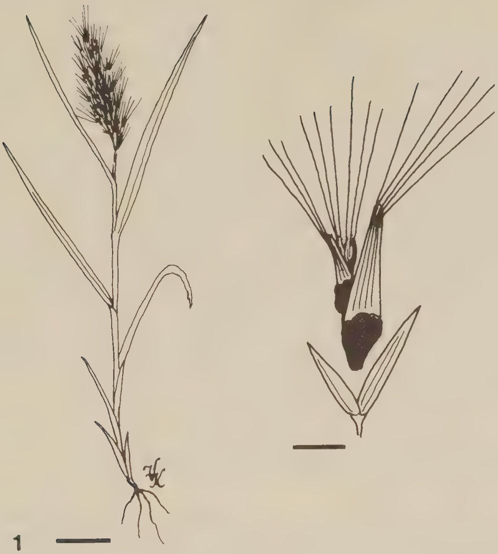
Type not seen. Description taken from the original.

Key to the smut fungi of *Apluda*.

1. Sori in the leaves .... *Melanotaenium apludae*
– Sori in the ovaries or in the spikelets 2
2. Spores 18–40 µm long .... *Tilletia apludae*
– Spores smaller 3
3. Sori in all spikelets of an inflorescence. Spores 5–7 µm long ....
.... *Sporisorium apludae*
– Sori in some spikelets of an inflorescence. Spores 8–13 µm long 4
4. The fungus produces witches' brooms. Outer spores verruculose ....
.... *Sporisorium mishrae*
– The fungus does not produce witches' brooms. Outer spores prominently echinulate .... *Sporisorium apludae-aristatae*

THE SMUT FUNGUS OF *BOISSIERA* (GRAMINEAE).

Revising the smut fungi of the tribe Pappophoreae, I checked a specimen obtained from Dr. Sultan Ahmad (Lahore, Pakistan), labelled as "*Ustilago pappophori* Pat. on *Pappophorum*". The host plant turned out to be *Boissiera squarrosa* (Banks & Sol.) Nevski (subfam. Pooideae, tribe Bromeae), and its smut an undescribed species:



1

Fig. 1. Sori of *Ustilago boissierae* K. Vánky in the spikelets of *Boissiera squarrosa* (Banks & Sol.) Nevski. Enlarged a spikelet with the bullate sori on the basal part of the floral envelopes and the intact glumes (type). Bars = 1 cm and 1 mm respectively.

Ustilago boissierae K. Vánky, **sp. nov.**

Typus in matrice *Boissiera squarrosa* (Banks & Sol.) Nevski (*Pappophorum squarrosum* Banks & Sol.), Pakistan, Quetta, Spinkarez, 4.VI.1953, leg. S. Ahmad (9034). Holotypus in Herbario Ustil. Vánky (HUV 8980!), isotypus in BPI 165185. Paratypus in matrice *Boissiera squarrosa*, Afghanistan, Kabul Prov., pr. Charasyab, alt. 1850 m, 20.VII.1972, leg. ?, HUV 14819!

Sori in spiculis, partes basales integumenti floralis et ovaria destruentes, sed glumas intacte reliquentes, bullati, primo epidermide cooperti, illo rupto massam sporarum primo agglutinatam, serius pulveream, nigram ostendentes. Sporae globosae, subglobosae, ovoideae, magnitudina satis variabiles, (8–)9–13,5 x (9–)9,5–14(–15) µm, rufulobrunneae, in nonnullis sporarum taenia obscurior, aequatorialis; pariete 1–2 µm crasso, dense, subtiliter verruculoso.

Sori (Fig. 1) in the spikelets, destroying the basal parts of the floral envelopes and the ovaries but leaving the glumes intact, bullate, at first covered by the epidermis which ruptures disclosing the first agglutinated, later powdery, black mass of spores. Spores (Figs. 2, 3) globose, subglobose, ovoid, rather variable in size, (8–)9–13.5 x (9–)9.5–14(–15) µm, reddish-brown, in some of the spores with a darker equatorial band; wall 1–2 µm thick, densely, finely verruculose.

The monotypic *Boissiera* from S.W. Asia is closely related to *Bromus* but morphologically distinct from it. Because of superficial similarity, it is often confused with the unrelated *Pappophorum*. Indeed, the smut fungus of *Boissiera* is also related to *Ustilago bullata* Berk., a common smut on a great number of *Bromus* species. However, *Ustilago boissierae* differs from *U. bullata* by the larger size of the spores. In *U. bullata* the spores measure 6.5–9.5 x 8–11 µm.

A large-spored smut was described from North America on *Bromus ciliatus* L., under the name of *U. bullata* Berk. var. *macrospora* (Farlow) G. W. Fischer, 1953:250 (based on *Ustilago bromivora* (L.-R. & C. Tul.) Fischer v. Waldh. var. *macrospora* Farlow) possessing spores of 10–17(–19) µm in diameter. Its relationship to *U. boissierae* is unclear. A sample of "*U. bullata*" on *Bromus ciliatus* I have seen (in Fischer, Gramin. smuts N. Amer. No. 228, HUV 10051) has spores of 8–11 x 9.5–13(–14.5) µm.

THE SMUT FUNGI OF *BRACHIARIA* (GRAMINEAE).

The grass genus *Brachiaria*, from the tropics and subtropics mainly of the Old World, with its ca. 100 species, belongs to the subfam. Panicoideae, tribe Paniceae, subtribe Setariinae (Clayton & Renvoize, 1986). On *Brachiaria* at least ten smut fungi have been reported: **1**. *Melanotaenium brachiariae* Viégas, **2**. *Sorosporium brachiariae* Hopkins, **3**. *Sorosporium brachiariae-ramosae* Ramakrishnan, **4**. *Sorosporium ovarium* Griffiths, **5**. *Sphacelotheca diplospora* (Ellis & Everhart) G. P. Clinton var. *verruculosa* G. P. Clinton, **6**. *Sphacelotheca serrata* L. Ling, **7**. *Sporisorium ordense* R. G. Shivas & K. Vánky, **8**. *Tilletia pulcherrima* Ellis & Galloway var. *brachiariae* Pavgi & Thirumalachar, **9**. *Tolyposporella brachiariae* Thirumalachar & Mundkur, and **10**. *Ustilago operta* H. & P. Sydow & Butler. Of these, several are synonyms. *Tolyposporella brachiariae* and *Melanotaenium brachiariae* represent the same fungus. According to Ling (1953a:191), *Sorosporium brachiariae* and *Sphacelotheca diplospora* var. *verruculosa* are synonyms of *Sorosporium ovarium*. Ling's opinion was confirmed by the study of the types of these smuts. Moreover, *Sorosporium brachiariae-ramosae* was also found to be indistinguishable from *Sorosporium ovarium*. This fungus shows characters of a *Sporisorium*. Its name and synonyms should be:

Sporisorium ovarium (Griffiths) K. Vánky, **comb. nov.**

Basionym: *Sorosporium ovarium* Griffiths, Bull. Torrey Bot. Club 34:209, 1907. — Lectotype on *Panicum caespitosum* Swartz (= *Brachiaria reptans* (L.) Gard. & C. E. Hubb.), Mexico, (designated by Zundel, 1953:68) Hidalgo, Dublan, 9.IX.1905, D. Griffiths (BPI 180088!).

Sphacelotheca diplospora (Ellis & Everhart) G. P. Clinton var. *verruculosa* G. P. Clinton, 1906:27. — Type on *Panicum* sp. (= *Brachiaria meziana* Hitchc., comp. Ling, 1953a:191), Mexico, near Mexico City, Lecheria, 5.VII.1904, C. G.

Pringle (NHES, BPI 177481!).

Sorosporium brachiariae J. C. Hopkins, 1938:109 & 126. — Type on *Brachiaria brizantha* Stapf, Rhodesia [= Zimbabwe], Salisbury [= Harare], 26.I.1932, J. C. Hopkins, Herb. Dept. Agricult. Southern Rhodesia No. 1860. Isotypi in PREM (30370!) and in BPI (179468! & 195141).

Sorosporium brachiariae-ramosae Ramakrishnan, 1952:113. — Type on *Brachiaria ramosa* Stapf, India, Tamil Nadu, Coimbatore, Pollachi, 20.VIII.1912, S. Sundararaman (HCIO 19814!).

Sori in all ovaries of an inflorescence, hidden by the floral envelopes, subcylindrical or with subacute tips, 1–1.5 x 2–3.5 mm, first covered by a light brown, leathery peridium which ruptures irregularly from its apex exposing the chocolate-brown, semipowdery mass of spore balls and a columella with short branches or 2–3 short, filiform columellae. Spore balls loose, many-spored, 35–100 x 45–130 μm or larger, reddish-brown. Spores subglobose, ovoid, broadly ellipsoidal or irregularly subpolyhedral, 8–10.5 x 8.5–11(–12) μm, yellowish- to reddish-brown; wall even, ca. 0.8 μm thick, densely, uniformly, finely echinulate causing the spore edge to appear finely serrulate. Sterile cells few, in small, irregular groups, in short chains or single, globose, ellipsoidal, flattened on contact sides, 9–18 μm long, hyaline, content granular, wall 1–1.5 μm thick, smooth.

The comparison of the types of *Melanotaenium brachiariae*, *M. echinochloae* and *Tolyposporella brachiariae* could not reveal any essential difference, hence they are considered synonyms. On the contrary, the morphology of both the sori and spores of *M. brachiariae* var. *arthraxonis* Thirumalachar & Pavgi on *Arthraxon* sp. is so different that this fungus was raised to specific rank as *M. arthraxonis* (Thirum. & Pavgi) K. Vánky (1997:144).

Melanotaenium brachiariae Viégas, 1944:748.

Type on *Brachiaria plantaginea* (Link) Hitchc., Brazil, Est. de São Paulo, Mogí-Mirim, Faz. Emílio Spina, 27.II.1941, A. P. Viégas (IACM). Isotype in HCIO (11662!).

Tolyposporella brachiariae Thirumalachar & Mundkur, in Mundkur & Thirumalachar, 1946:5. — Type on *Brachiaria distachya* (L.) Haines, India, Bangalore, Karnataka, 14.II.1942, M. J. Thirumalachar (HCIO 10339-103341!, as "14.XII.1942").

Melanotaenium echinochloae M. S. Patil, 1992:180. — Type on "*Echinochloa* sp." (= misnamed *Brachiaria distachya* (L.) Haines, teste Vánky), India, Maharashtra State, Kolhapur, Shivaji University Campus, 8.X.1978, M. S. Patil (HCIO 30109). Isotype in HUV (15494!).

Sori on the leaves, leaf-sheaths, stems and also on floral axis and rachis, first as yellowish-green, later lead coloured, nonerumpent spots, on the leaves linear or by coalescence fusiform or irregular, sometimes covering nearly the whole leaf blade, 0.3–5 x 1–20(–30) mm, on the stems up to 80 mm long. Spores embedded in the host tissues, crowded, often in irregular groups or rows; single spores ovoid, ellipsoidal, usually irregularly subpolyhedral, (6.5–)7–12 x 8–14(–16) μm, dark reddish-brown; wall uneven, thickest at the angles, 1–3 μm wide, smooth.

Sporisorium serratum (L. Ling) K. Vánky, **comb. nov.**
Basionym: *Sphacelotheca serrata* L. Ling, Lloydia 16:183, 1953a. — Type on *Brachiaria serrata* Stapf, Nyasaland [= Malawi], Lilongwe, IX.1950, G. Jackson (IMI 44074!).

Sori in ovaries, infecting all the spikelets of an inflorescence, ovoid to subcylindrical, ca. 1 x 2–3 mm, each covered by a peridium of host and fungus origin which ruptures at maturity exposing a blackish-brown, dusty mass of easily disintegrating spore balls and a short columella. Spores subglobose, ellipsoidal to usually irregularly subpolyhedral, 6–8 x 6.5–9 µm, medium reddish-brown; wall thin (ca. 0.7 µm), even or slightly thicker at the angles, from apparently smooth to punctate or very finely verruculose. Fungal cells of the peridium globose to irregular, 4–9.5 x 4.5–11.5 µm, hyaline with ca. 1 µm thick, smooth wall.

Sporisorium ordense R. G. Shivas & K. Vánky (1997, in press).
Type on *Brachiaria pubigera* (Roem. & Schult.) S. T. Blake, Australia, Western Australia, Kimberley region, Lake Kununurra, 15°50' S, 128°45' E, alt. ca. 50 m, 28.II.1995, leg. R. G. Shivas. Holotypus in PERTH (3802140), isotypus in HUV (17437!).

For description and illustration of this species see Shivas & Vánky (1997).

Tilletia brachiariae (Pavgi & Thirumalachar) K. Vánky, **comb. et stat. nov.**
Basionym: *Tilletia pulcherrima* Ellis & Galloway ex G. P. Clinton var. *brachiariae* Pavgi & Thirumalachar, Mycologia 44:323, 1952. — Type on *Brachiaria distachya* Stapf, India, Uttar Pradesh, Benares [Varanasi], 14.IX.1950, M. S. Pavgi (HCIO 20129!, as on "8.XI.1950").

Sori in some of the ovaries, ovoid, slightly protruding beyond the glumes, 2–3 x 3–4 mm, covered by a first green later dark brown membrane which ruptures at maturity disclosing the black, powdery mass of spores intermixed with sterile cells. Spores globose, subglobose, rarely broadly ellipsoidal, 18–22(–24) x 19–24(–26) µm, medium to dark reddish-brown; wall 2.5–4 µm thick, including the truncate warts. Sterile cells globose to ovoid, 13–25 µm in diameter, hyaline, wall 1.5–3 µm thick, smooth.

Comparison of the types of *Tilletia pulcherrima* Ellis & Galloway ex G. P. Clinton (lectotype on *Panicum virgatum* L., USA) and *T. brachiariae* revealed that the spores of the first species are larger and darker than those of *T. brachiariae*, measuring 20–28(–32) x (20–)22–28(–32) µm. (For detailed description of *T. pulcherrima* see Vánky, 1990:272, under the name of *Neovossia pulcherrima*).

According to Pavgi & Thirumalachar (1952:323) the smut fungus on *Eriochloa procera* Hubb. (India, Uttar Pradesh, Benares [Varanasi], 20.IX.1950, M. S. Pavgi) also belongs to this taxon.

Ustilago operta H. & P. Sydow & Butler, 1906:426.

Sphacelotheca operta (H. & P. Sydow & Butler) Zundel, 1953:187. — Type on *Panicum villosum* Lamk. (= *Brachiaria villosa* (Lamk.) A. Camus), India, Coimbatore, Mts. Nilgiri Hills, Ootacamund [= Ooty], 1.X.1901, C. A. Barber (HCIO 448!).

Sori in the spikelets destroying the inner floral organs and the basal part of the floral envelopes, which are swollen, leaving the glumes and the sterile lemma intact, inconspicuous, 1–2 mm in diameter, first covered by the epidermis which ruptures disclosing the dark brown, powdery mass of spores. Spores globose, subglobose, ovoid to ellipsoidal, (7–)8–11 x 9–13(–14) µm, light olivaceous-brown; wall even, ca. 0.8 µm thick, finely, densely echinulate which just affects the spore profile. Sterile cells absent.

Key to the smut fungi of *Brachiaria*.

1. Sori in the leaves and stems .... *Melanotaenium brachiariae*
– Sori elsewhere 2
2 Sori in the spikelets, spores 9–14 µm long, echinulate .... *Ustilago operta*
– Sori in the ovaries...3
3. Spores 19–26 µm long, verrucose .... *Tilletia brachiariae*
– Spores smaller 4
4. Spores 8.5–12 µm long, echinulate ....*Sporisorium ovarium*
– Spores smaller 5
5. Spores 7–10 µm long, echinulate. Sori in some of the ovaries
of an inflorescence .... *Sporisorium ordense*
– Spores 6.5–9 µm long, smooth to punctate-verruculose.
Sori in all ovaries of an inflorescence ....*Sporisorium serratum*

THE SMUT FUNGI OF *MELINIS* AND *RHYNCHELYTRUM* (GRAMINEAE).

Melinis and *Rhynchelytrum* are closely related genera in the subfam. Panicoideae, tribe Paniceae, subtribe Melinidinae (Clayton and Renvoize, 1986:295). Recent authors consider them to be one genus, *Melinis*, with ca. 25 known species. On these, three smut fungi have been described: *Cintractia melinis* Zundel, *Ustilago rhynchelytri* L. Ling, and *Sporisorium rhynchelytri* Durán. The study of the types and other specimens revealed that *U. rhynchelytri* is identical with *C. melinis*, both showing characters of a *Sporisorium*:

Sporisorium melinis (Zundel) K. Vánky, **comb. nov.**

Basionym: *Cintractia melinis* Zundel, Bothalia 3:302, 1938. — Type on *Melinis tenuinervis* (Stapf) Stapf (= *M. minutiflora* P. Beauv.), South Africa, Western Cape Prov., Capetown, 12.VI.1914, coll. C. W. Malley. Holotype in PREM (19860!), isotypes in BPI (141632! & 171971!).

Ustilago rhynchelytri L. Ling, 1953b:153. — Type on *Rhynchelytrum repens* (Willd.) Hubb. (= *Melinis repens* (Willd.) Zizka), Nyasaland [= Malawi], Lilongve, 5.IV.1951, G. Jackson. Holotype in IMI (49714!), isotype in BPI (166085!).

Sori in the spikelets destroying the flowers, leaving the glumes and often also the tips of the floral envelopes intact, inconspicuous, globoid, subpyramidal, ovoid, elongated or V-shaped, ca. 1 x 1–3 mm, first covered by a thin peridium of host and fungus origin which ruptures disclosing an agglutinated, blackish-brown mass of spores with powdery surface, surrounding a short, stout, simple or V-shaped columella, corresponding to the destroyed two flowers in the spikelet. Spores broadly ellipsoidal, ovoid, elongated or irregular, 8–10.5 x 9–14(–16) µm, reddish-brown; wall even, ca. 0.8 µm thick, from finely, densely punctate-verruculose to finely, densely echinulate. Sterile cells between the spores not seen.

On *Melinis minutiflora* P. Beauv. (*M. tenuinervis* (Stapf) Stapf), *M. nerviglumis* (Franch.) Zizka, *M. repens* (Willd.) Zizka subsp. *repens* (*Rhynchelytrum repens* (Willd.) C. E. Hubb.), Central and South Africa.

Collections may differ in the coarseness of the spore ornamentation. Especially, collections on *M. nerviglumis* have finely punctate-verruculose, not finely echinulate spores.

Sporisorium rhynchelytri Durán, 1987:117.

Type on *Rhynchelytrum roseum* (Nees) Stapf & C. E. Hubb. (= *Melinis repens* (Willd.) Zizka), Mexico, Durango State, 34.2 km S.E. of Durango, off Hwy 45, alt. 2042 m, 7.XI.1976, coll. R. Durán & P. M. Gray (WSP 67742!).

Sori flagelliform, several cm long, replacing the inflorescence. Spores 10–15 µm in diameter, minutely, densely echinulate-verruculose. Sterile cells hyaline, about the size of the spores or smaller, in chains or irregular groups, intermixed with the spores.

Known only from Mexico. For detailed description and illustration see Durán, 1987:117 & 121.

Key to the smut fungi of *Melinis* (incl. *Rhynchelytrum*).

- Sori in the spikelets, 1–3 mm long .... *Sporisorium melinis*
- Sori replacing the inflorescence, flagelliform, several cm long ...*S. rhynchelytri*

THE SMUT FUNGI OF *VETIVERIA* (GRAMINEAE).

Ten species of *Vetiveria* (subfam. Panicoideae, tribe Andropogoneae, subtribe Sorghinae) are known from the Old World tropics (Clayton & Renvoize, 1986:342). The most common species is *V. zizanioides*, also cultivated for the aromatic oil obtained from its roots. On this plant four smut fungi have been described from S. Asia (India, Sri Lanka): **1.** *Macalpinomyces effusus* (H. & P. Sydow) K. Vánky, **2.** *Tilletia vetiveriae* Pavgi & Thirumalachar, **3.** *Tolyposporella linearis* (Berk. & Br.) L. Ling, and **4.** *Ustilago vetiveriae* Padwick. On the rather similar *V. nigritana* a fifth smut fungus was reported from Africa: *Sphacelotheca chudaei* Har. & Pat. This fungus shows characters of a *Sporisorium*. Scrutiny of herbarium material revealed a further, still unknown smut:

Macalpinomyces nigritanae K. Vánky, **sp. nov.**

Typus in matrice *Vetiveria nigritana* (Benth.) Stapf, Sierra Leone, Eastern Prov., Madina, 20.VII.1946, leg. F. C. Deighton. Holotypus in Herbario Ustil. Vánky (HUV 17970!). Paratypus in matrice *Vetiveria ?zizanioides* (L.) Nash, Ghana, Nyankpola, 8.III.1958, leg. McEwen (HUV 17969! In absence of a healthy sample it was not possible to check the host plant identity).

Sori, similiter illis fungi *Macalpinomyces effusus* (H. & P. Sydow) K. Vánky, in intimis partis distalis tortae culmi evoluti. Maturitate eorum culmi longitudinaliter discissi massam brunneam, semiagglutinatam sporarum, gregibus cellularum sterilium intermixtam ostendentes. Columella nulla. Sporae globosae, subglobosae, late ellipsoidales usque parum irregulares, (8–)9–11 x 9–12 µm, olivaceobrunneae; pariete aequali, cca. 0,8 µm crasso, leniter, dense verruculoso, propter hoc in extermis lineis leviter undulato. Cellulae steriles in greges irregulares, plerumque magnos, in speciminibus veteribus plerumque collapsos dispositae. Cellulae steriles singulae 8-12 µm longae, hyalinae, tenuiter (cca. 0,5 µm) tunicatae, leves.

Sori, similar to those of *Macalpinomyces effusus*, in the interior of the twisted distal part of the culms. At maturity the culms split longitudinally disclosing the dark brown, semiagglutinated mass of spores intermixed with groups of sterile cells. No columella. Spores (Figs. 4, 5) globose, subglobose, broadly ellipsoidal to slightly irregular, (8–)9–11 x 9–12 µm, olivaceous-brown; wall even, ca. 0.8 µm thick, finely, densely verruculose, which causes the spore profile to appear finely wavy. Sterile cells in irregular, usually large groups, collapsed in old specimens. Single cells 8–12 µm long, hyaline, thin-walled (ca. 0.5 µm), smooth.

The spores of the paratype are slightly larger (with ca. 0.5 µm) than those of the type. Groups of sterile cells are also more frequent in the paratype than in the type. These differences are considered variations within the species.

Macalpinomyces nigritanae differs from *M. effusus* (H. & P. Sydow) K. Vánky especially in the size of the spores and sterile cells. In *M. effusus* these measure only 3.5–5.5 x 4–6(–6.5), and 5.5–8 µm, respectively.

Macalpinomyces effusus (H. & P. Sydow) K. Vánky, 1997:129.

Ustilago effusa H. & P. Sydow, in H. & P. Sydow & Butler, 1906:425. — *Endosporisorium effusum* (H. & P. Sydow) K. Vánky, 1995:212. — Type on *Andropogon muricatus* Retz. (= *Vetiveria zizanioides* (L.) Nash), India, Kanaighat, Sylhet, 21.V.1905, E. J. Butler. Holotype in HCIO 450!

For its description see Vánky, 1995:212 (sub *Endosporisorium effusum*).

Sporisorium chudaei (Hariot & Patouillard) K. Vánky, **comb. nov.**

Basionym: *Sphacelotheca chudaei* Hariot & Patouillard, Bull. Soc. Mycol. France 26:208, 1910. — Type on "*Panicum turgidum* Forsk." (= misnamed *Vetiveria nigritana* (Benth.) Stapf, teste A. Camus), Mauritania [= Algeria], Biakh, 25.I.1908, R. Chudeau. Holotype in PC, isotypes in BPI 177313, 177314, HUV 16786! and IMI 34549.

Sori in the racemes transforming them into irregular, elongated bodies of 1–2 x 5–25 mm, first covered by a thick, brown peridium which ruptures irregularly and flakes away disclosing the dark brown, powdery mass of spores intermixed with sterile cells. Finally, on the inflorescence axis only whorls of twisted columellae are left behind, corresponding to the more or less destroyed raceme axes. Spores in large, easily decomposing balls. Single spores subglobose, ellipsoidal to slightly irregularly subpolyhedral, 5–7 x 5.5–8(–9.5) µm, yellowish-brown; wall uniform, thin (ca. 0.8 µm), from apparently smooth to finely and densely or moderately densely punctate-verruculose, which does not affect the spore profile. Sterile cells in irregular groups or chains, collapsed in old specimens. Single cells larger than the spores, 7–16 µm long, pale yellow; wall thin (ca. 0.5 µm), smooth.

Tolyposporella linearis (Berkeley & Broome) L. Ling, 1949:133.

Gymnosporium lineare Berkeley & Broome, 1875:90. — *Coniosporium lineare* (Berk. & Br.) Saccardo, 1886:243. — *Ustilago linearis* (Berk. & Br.) Petch, 1924:167. — *Sorosporium lineare* (Berk. & Br.) Thirumalachar, Whitehead & O'Brien, 1967:394. — Type on *Andropogon muricatus* Retz (= *Vetiveria zizanioides* (L.) Nash), Ceylon [= Sri Lanka], III.1868, G. H. K. Thwaites (506).

Sori on both sides of the leaves, forming short linear striae, 2–7 mm long, first covered by host tissue which ruptures later disclosing a black, agglutinated spore mass. Spore balls varying in shape and size, composed of many firmly agglutinated spores. Spores irregular in shape, smooth, thick-walled; outer spores deep smoky brown, polyhedral, usually 7.5–13.5 x 9–16 µm, the elongate ones up to 21 µm long, epispores up to 4 µm thick, with pronounced thickenings at the angles; inner spores usually lighter in colour, subglobose to polyhedral, chiefly 7–12 µm long.

Type not seen. Description taken from Ling (1949:133).

Tilletia vetiveriae Pavgi & Thirumalachar, in Thirumalachar & Pavgi, 1956:285.

Type on *Vetiveria zizanioides* (L.) Nash, India, Uttar Pradesh, Banaras (Varanasi), 12.IX.1952, M. S. Pavgi. Holotype in HCIO 20999!

Sori in ovaries, scattered in the inflorescence, inconspicuous, showing as small, 1(–1.5) x 2–3 mm, somewhat irregular or pyriform, dark brown bodies between the glumes, covered by the pericarp, filled with spores. Spore mass black, powdery, composed of spores of various darkness intermixed with sterile cells. Spores globose, subglobose, ovoid to ellipsoidal. The chocolate-brown spores measure 13.5–20 x 15–25 µm and are provided with coarse, densely situated, pyramidal, ca. 1.5 µm high warts. Light yellowish-brown spores (immature spores ?) somewhat smaller, but having the same ornamentation as the dark spores. Sterile cells numerous, subglobose, ellipsoidal to irregularly subpolyhedral, 10–20 x 10–23 µm, subhyaline to pale yellowish-brown; wall 1–2 µm thick, smooth.

Ustilago vetiveriae Padwick, 1946:5.

Type on *Vetiveria zizanioides* (L.) Nash, India, Bengal, Dacca, Tejgaon, 23.XI.1944, G. W. Padwick (899). Holotype in HCIO 10819!

Sori in some ovaries of the inflorescence, long cylindrical, twisted, 1–1.5 x 5–15 mm, first covered by a greyish-brown membrane which ruptures longitudinally to disclose the brown, semiagglutinated to powdery mass of spores. Spores globose, subglobose to ellipsoidal, 6.5–9 x 6.5–10.5 µm, olivaceous-brown; wall uniform, ca. 1 µm thick including ornamentation, densely low verrucose-tuberculate to subechinulate. Spore germination (on water-agar, at room temp., after 1 day) results in septate basidia, ca. 1.5 x 20–55 µm, on which laterally and terminally, on well developed sterigmata, long, fusiform basidiospores are produced measuring 1–1.5 x 5–20 µm. The basidiospores give rise to fusiform sporidia. In some specimens, between the spores, groups of hyaline, thin-walled (ca. 0.5 µm) cells are present measuring 5–12 µm in diameter. The origin and taxonomic significance of these cells are not known.

On *Vetiveria zizanioides* (L.) Nash, S. Asia (India).

Key to the smut fungi of *Vetiveria*.

1. Sori in the ovaries 2
– Sori elsewhere 3
2. Spores 15–25 µm long, with coarse, 1.5 µm high warts .... *Tilletia vetiveriae*
– Spores 6.5–10.5 µm long, with low tubercles .... *Ustilago vetiveriae*
3. Sori in the racemes. Columella present .... *Sporisorium chudaei*
– Sori elsewhere. Columella absent 4
4. Sori in the leaves. Spore balls present. Sterile cells absent .... *Tolyposporella linearis*
– Sori in the culms. Spore balls absent. Sterile cells present 5
5. Spores 9–12 µm long. Sterile cells 8–12 µm long .. *Macalpinomyces nigritanae*
Spores 4–6.5 µm long. Sterile cells 5.5–8 µm long ...... *Macalpinomyces effusus*

THE SMUT FUNGI OF *LEPIDOSPERMA* (CYPERACEAE).

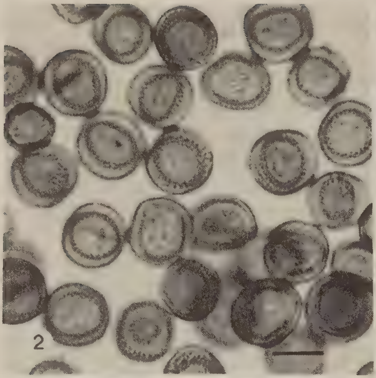
The genus *Lepidosperma*, with ca. 60 known species from Australia, S.E. Asia, New Caledonia and New Zealand, is represented in Australia by ca. 55 species of which ca. 53 are endemic (Wilson, 1993:308). On these, McAlpine (1910) described two smut fungi: *Tolyposporium lepidospermae* and *T. rodwayi*.

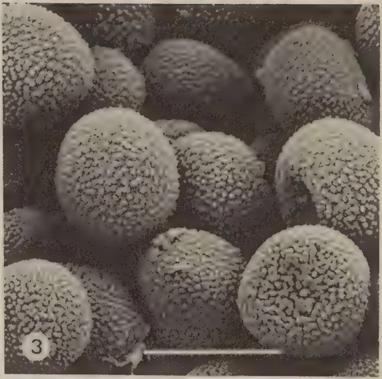
Tolyposporium lepidospermae McAlpine, 1910:188.

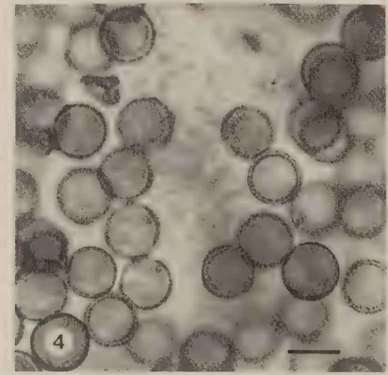
Thecaphora lepidospermae (McAlp.) Thirumalachar & Neergaard, 1977(1978):187. — Type on *Lepidosperma angustatum* R. Br., Australia, Victoria, Stawell, 3.II.1904, Reader. Holotype in VPRI 3005!

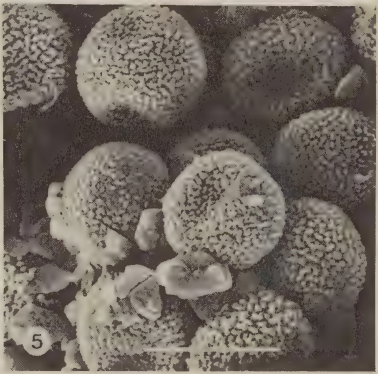
Sori in the spikelets completely hidden by the floral envelopes, forming a black, granular-powdery mass of spore balls around the internal floral organs. Infection systemic; all spikelets of an inflorescence are affected and become slightly swollen. Spore balls subglobose, ovoid to slightly irregular, (20–)25–45(–50) x (25–)30–60 µm, reddish- or blackish-brown to opaque, composed of (3–)6–30 (or more?) firmly united spores. Spores irregular with rounded free surface and flattened contact sides, 12–16 x 12–18 µm, reddish- to chestnut-brown; wall of the free surface 2.5–3 µm thick, densely, irregularly, coarsely verrucose; wall of the contact sides thin (ca. 0.5 µm), smooth.

On various *Lepidosperma* species in Australia: *L. angustatum* R. Br., *L. gracile* R. Br., *L. gunnii* Boeck., *L. pubisquamum* Steudel, and *L. semiteres* F. Muell. ex Boeck.









Figs. 2, 3. Spores of *Ustilago boissierae* K. Vánky in LM and in SEM (type).
Figs. 4, 5. Spores and sterile cells of *Macalpinomyces nigritanae* K. Vánky on *Vetiveria nigritana* (Benth.) Stapf in LM and in SEM (type). Bars = 10 μm.

Tolyposporium rodwayii McAlpine, 1910:189.
Thecaphora rodwayii (McAlp.) Thirumalachar & Neergaard, 1977(1978):188. — Type on *Lepidosperma laterale* R. Br., Australia, Tasmania, Longley, XII.1891, L. Rodway. Holotype VPRI 3007!, isotype HO 1388!

Sori as in *T. lepidospermae*. Spore balls subglobose, ovoid, elongated or irregular, 30–60 x 35–100(–110) μm, reddish- to blackish-brown, composed of 20–100? (or more?) firmly united spores. Spores subpyramidal or irregular, flattened on contact sides, in surface view polyangularly irregular, 5–12 x 8–17 μm, in optical median view subcuneiform, 8–25 μm long, reddish- to chestnut-brown; wall of the free surface 2–3 μm thick, finely, sparsely, irregularly verruculose, with a rounded, light germ pore of 3–3.5 μm diameter; wall of contact sides thin (ca. 0.5 μm), smooth.

On various *Lepidosperma* species in Australia and New Zealand: *L. effusum* Benth., *L. gladiatum* Labill., *L. gunnii* Boeck., *L. laterale* R. Br.

A third, peculiar smut fungus was recently collected in Tasmania and described as ***Heterotolyposporium lepidospermae*** K. Vánky (in press) on *Lepidosperma ensiforme* (Rodway) D. I. Morris. It produces hidden sori in the spikelets, forming naked, grey spore masses composed of two kinds of spores: reddish-brown, thick-walled ones, single or agglutinated in rather permanent spore balls, and colourless, thin-walled, smaller, single spores. By germination, both kinds of spores give rise to the same kind of septate basidia.

A screening of smutted *Lepidosperma* species revealed a further *Tolyposporium* species, characterised especially by its large spore balls:

Tolyposporium megaglomerulosum K. Vánky, **sp. nov.**

Typus in matrice *Lepidosperma gunnii* Boeck. (det. D. I. Morris, HO), Australia, Victoria, cca. 110 km S.W. Melbourne, 1 km S.W. pag. Anglesea, 3.III.1996, leg. C. & K. Vánky. Holotypus in BRIP, isotypi in Herbario Ustil. Vánky (HUV 17828) et in Vánky, Ust. exs. No. 985. Paratypi in matricibus *Lepidosperma concavum* R. Br., Tasmania, 172 km N.E. Hobart, inter oppid. Cranbrook et Bicheno, alt. ca. 35 m, 8.III.1996, leg. C. & K. Vánky (HO; HUV 17834); *Lepidosperma filiforme* Labill., Tasmania, Tasman Peninsula, pr. Tasman Arch, alt. ca. 40 m, 10.III.1996, leg. C. & K. Vánky (HO; HUV 17835); et *Lepidosperma longitudinale* Labill., Tasmania, 84 km N.E. Hobart, Oxford, alt. ca. 2 m, 8.III.1996, leg. C. & K. Vánky (HO; HUV 17837).

Tolyposporium megaglomerulosum a fungis *Tolyposporium lepidospermae* McAlpine (1910:188) et a *T. rodwayii* McAlpine (1910:189) imprimis glomerulis sporarum multo majoribus: 50–100(–110) x 60–150(–160) µm, e sporis pluribus compositis distinctum.

Sori (Fig. 6) as in *T. lepidospermae* and *T. rodwayii*. Spore balls (Figs. 9, 10) irregular, elongated, rarely subglobose, 50–100(–110) x 60–150(–160) µm, blackish-brown, opaque, composed of tens to hundreds of firmly united spores. Spores (Fig. 9) irregularly subpolyhedral, elongated or subcuneiform, in surface view polyangularly irregular, 4–12 x 8–16 µm, in optical median view 12–28 µm long, dark reddish- to blackish-brown; wall of the free surface 2–3 µm thick, moderately densely, irregularly verruculose, with a rounded, light germ pore of 3–3.5 µm diameter; wall of the contact sides thin (ca. 0.5 µm), smooth.

Key to the smut fungi of *Lepidosperma*.

1. Sori grey, with two kinds of spores...........*Heterotolyposporium lepidospermae*
– Sori black, with one kind of spores...2
2. Spore balls 25–60 µm long, composed of (3–)6–30 (or more?) spores.
Spores densely, coarsely verrucose.....................*Tolyposporium lepidospermae*
– Spore balls larger, with more spores..3
3. Spore balls 35–110 µm long, composed of 20–100? (or more?) spores.
Spores finely, sparsely verruculose.............................*Tolyposporium rodwayii*
– Spore balls 60–160 µm long, composed of tens to hundreds of spores.
Spores moderately densely verruculose ......*Tolyposporium megaglomerulosum*

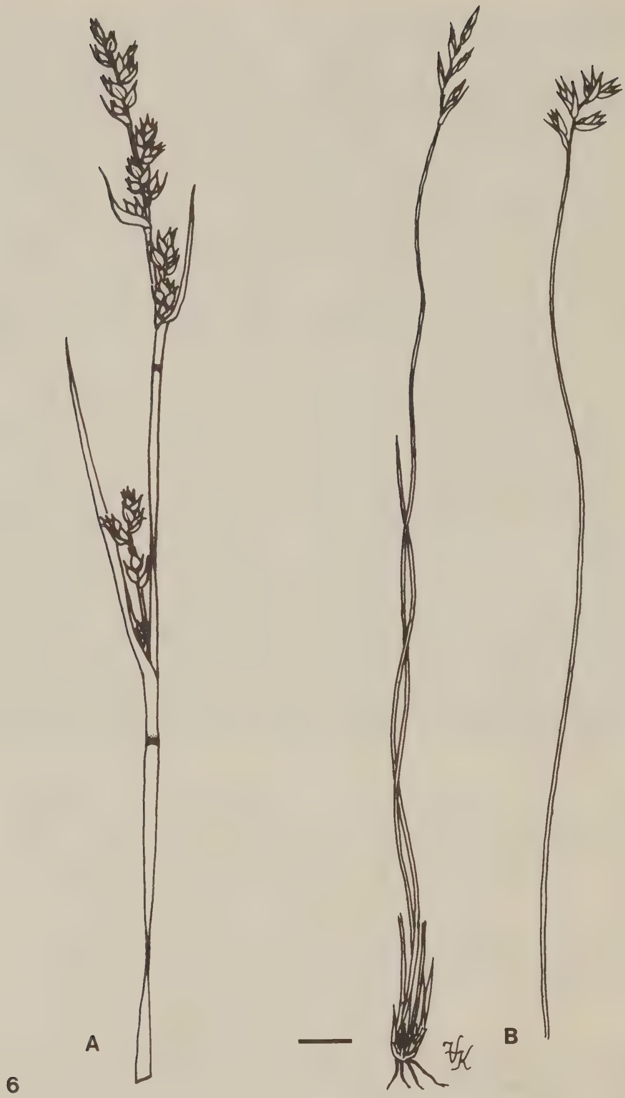


Fig. 6. Sori of *Tolyposporium megaglomerulosum* K. Vánky in the slightly swollen spikelets of A. *Lepidosperma gunnii* Boeck. (type), and B. *Lepidosperma filiforme* Labill. (paratype, with a healthy plant). Bar = 1 cm.

Our knowledge about the smut fungi of *Lepidosperma* is scanty. We do not know much about the host specificity of these smuts. However, this study revealed that the same *Tolyposporium* species may occur on several host plant species, and the same host plant species may be parasitised by more than one *Tolyposporium* species. E. g., a population of *Lepidosperma gunnii* was infected by both *T. lepidospermae* and *T. rodwayii*, producing different symptoms. The spikelets infected by *T. rodwayii* were more swollen and less acute than those infected by *T. lepidospermae*. There are samples of *Tolyposporium* which cannot be assigned with certainty to any of the known three species. Only the measurements (of the rather variable spore balls) and the number of the spores per spore ball (which is very difficult to count) are not proper to differentiate a greater number of species. These, complemented with other methods (e. g. molecular biological) may reveal further *Tolyposporium* species on *Lepidosperma*.

MELANOTAENIUM SPECIES OF *ISCHAEMUM* (GRAMINEAE).

Thirumalachar and Pavgi (1967(1968):25) described *Melanotaenium ischaemianum* Thirum. & Pavgi on the leaves of *Ischaemum semisagittatum* Roxb. (subfam. Panicoideae, tribe Andropogoneae, subtribe Ischaeminae), India, Maharashtra State, Khandala, 14.XI.1954, coll. M. J. Thirumalachar (No. 1242). I could not locate the type specimen but collected this fungus on the same host plant from the type locality, on 24.X.1995 (topotype, HUV 17508). A different *Melanotaenium* species was collected on *Ischaemum indicum* (Houtt.) Merrill:

Melanotaenium indicum K. Vánky, M. S. Patil & N. D. Sharma, **sp. nov.** Typus in matrice *Ischaemum indicum* (Houtt.) Merrill (*I. ciliare* Retz.), India, Maharashtra State, Kolhapur, Shivaji University Campus, alt. ca. 650 m., 24.X.1995, leg. K. Vánky. Holotypus in Herbario Ustil. Vánky (HUV 17508), isotypus in HCIO. Topotypus: 13.IX.1996, leg. M. S. Patil (HCIO, HUV 18032, Herb. Shivaji Univ., Kolhapur). Paratypus: India, Madhya Pradesh, Jabalpur, J. N. Agricultural University Campus, alt. ca. 410 m, 27.X.1996, leg. N. D. Sharma (HCIO, HUV 18022, Herb. J. N. Agricult. Univ. Jabalpur).

Sori ad folia, maculas parvas, elongatas, non erumpentes, nigras formantes, 0,2–0,5 x 0,3–1 mm, vel propter coalescentiam majores. Sporae in telis matricis immissae, subglobosae, ovoideae, late ellipsoidales usque parum irregulares, 7–11 x 8–13 µm, olivobrunneae; pariete 1–2,5(–3) µm crasso, bistratoso, parum inaequali, levi.

Sori (Fig. 7A) on the leaves forming small, elongated, nonerumpent, black spots, 0.2–0.5 x 0.3–1 mm, or larger by confluence. Spores (Fig. 11) embedded in the host tissue, subglobose, ovoid, broadly ellipsoidal to slightly irregular, 7–11 x 8–13 µm, olive-brown; wall 1–2.5(–3) µm thick, two-layered, slightly uneven, smooth.

Melanotaenium indicum differs from *M. ischaemianum* Thirum. & Pavgi in the appearance of the sori and in spore morphology and measurements. The sori of *M. ischaemianum* (Fig. 7 B) are large, ellipsoidal, measure 1–5 x 1.5–8 mm, the spores (Fig. 12) are dark olive brown, usually irregularly subpolyhedral, rarely ovoid, (8–)9–13(–15) x (9–)10–18 µm, including the irregularly thick spore wall which measures 1–5(–8) µm in diameter.

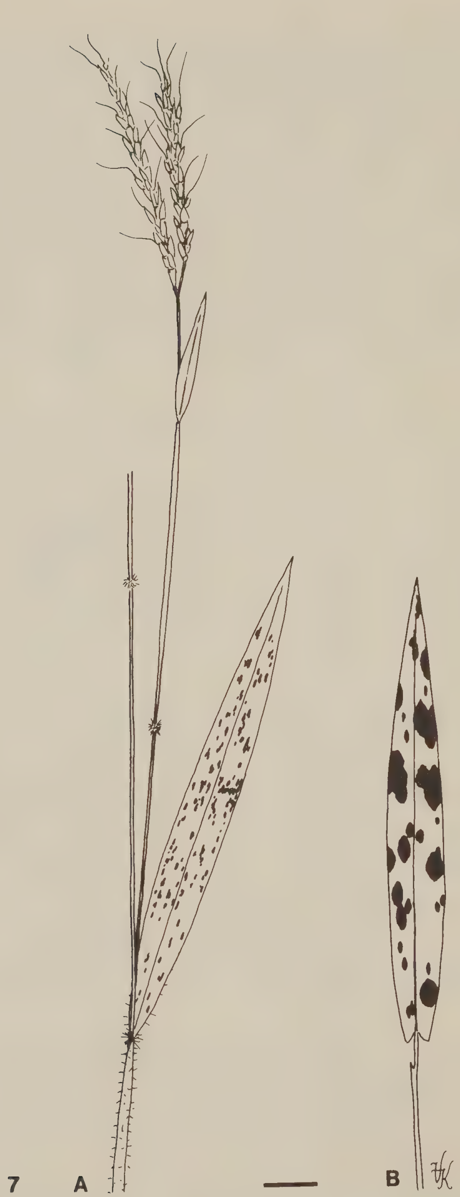


Fig. 7. A. Sori of *Melanotaenium indicum* K. Vánky, M. S. Patil & N. D. Sharma on *Ischaemum indicum* (Houtt.) Merrill (type). B. Sori of *M. ischaemianum* Thirum. & Pavgi on a leaf of *I. semisagittatum* Roxb. (topotype). Bar = 1 cm.

Key to the *Melanotaenium* species of *Ischaemum*.

- Sori 1.5–8 mm long. Spores irregular, (9–)10–18 µm long, spore wall 1–5(–8) µm thick .... *M. ischaemianum*
- Sori 0.3–1 mm long. Spores rather regular, 8–13 µm long, spore wall 1–2.5(–3) µm thick .... *M. indicum*

Our knowledge about *Melanotaenium* species of grasses is scanty. It is therefore interesting to notice that host species belonging to the same genus, from the same geographical area, can be parasitised by morphologically different *Melanotaenium* species. This is also true for *M. arundinellae* M. S. Patil and *M. tuberculatae* M. S. Patil on *Arundinella setosa* Trin. and *A. tuberculata* Munro, respectively.

A NEW SMUT OF *ISEILEMA* (GRAMINEAE).

I revised (Vánky, 1996:104-106) the smut fungi of *Iseilema* (Gramineae, subfam. Panicoideae, tribe Andropogoneae) and recognised four species. A smut fungus recently collected in India on *Iseilema prostratum* turned out to be different from these and is described as:

Sporisorium iseilematis-prostrati K. Vánky, **sp. nov.**

Typus in matrice *Iseilema prostratum* (L.) Anderss., India, Karnataka, 9 km N.W. urbe Hospet, 15°18' N, 76°19' E, alt. ca. 520 m, 15.XI.1995, leg. N. D. Sharma & K. Vánky. Holotypus in Herbario Ustil. Vánky (HUV 17537), isotypus in HCIO.

Sori racemos omnes inflorescentiae destruentes, in statu juvenili eorum spatheolis plus-minus obvoluti, cylindrici, 1 x 5–8 mm, primo cooperti peridio brunneolo, cito dissoluto, massam semiagglutinatam usque pulveream glomerulorum sporarum, sporarum, cellularumque sterilium et columellam centralem, simplicem vel breviter ramosam ostendenti. Glomeruli sporarum laxi, subglobosi, ellipsoidales vel irregulares, 40–80 x 40–100(–120) µm, atrobrunnei, e multitudine sporarum facile separabilum compositi. Sporae globosae, subglobosae usque late ellipsoidales, 5–6,5(–7) x 5,5–7(–8) µm, pallide olivaceobrunneae; pariete uniformi, cca. 0.5 µm crasso, dense, leniter verrucoso, sub SEM inter verrucas humiles, remotas, vel spinas valde subtiliter denseque verruculoso. Cellulae steriles sporis majores, subglobosae usque late ellipsoidales vel parum irregulares, 6–15 x 7–16 µm, singulae vel in greges parvos vel majores, irregulares dispositae, subhyalinae, pallide flavidobrunneae usque paene sporis aequaliter atrae; pariete 0.8–1.2 µm crasso, levi.

Sori (Fig. 8) destroying each raceme of the inflorescence, when young more or less enveloped by the spatheolae, cylindrical, 1 x 5–8 mm, first covered by a brownish peridium which early dehisces disclosing the dark brown, semiagglutinated to powdery mass of spore balls, spores, sterile cells, and a central, simple or shortly ramified columella. Spore balls loose, subglobose, ellipsoidal or irregular, 40–80 x 40–100(–120) µm, dark brown, composed of a great number of easily separating spores. Spores (Figs. 13, 14) globose,

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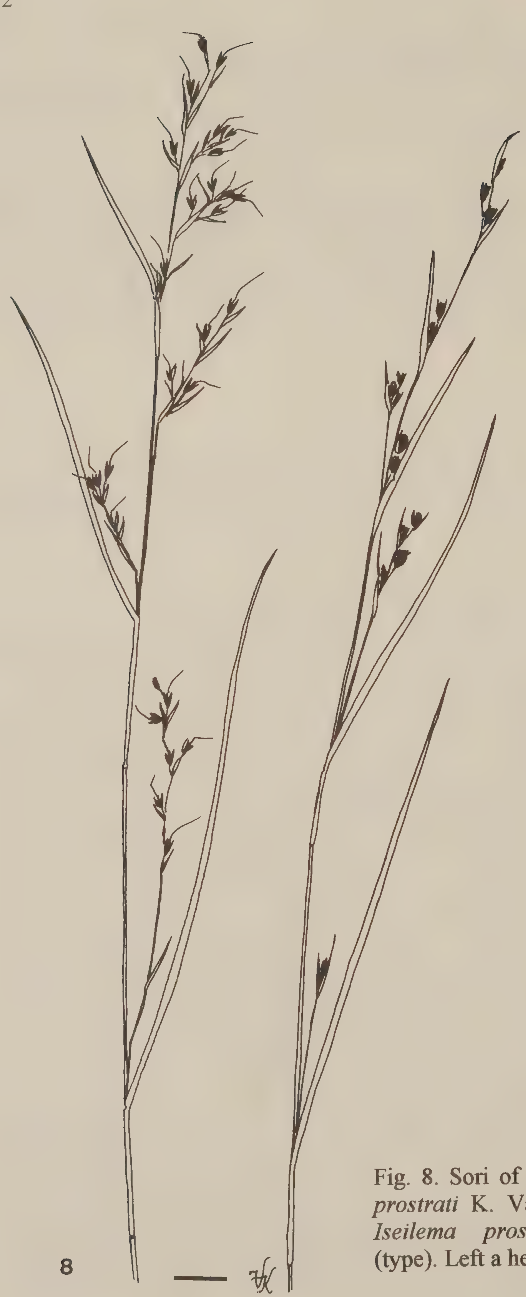


Fig. 8. Sori of *Sporisorium iseilematis-prostrati* K. Vánky in the racemes of *Iseilema prostratum* (L.) Anderss. (type). Left a healthy inflorescence.
Bar = 1 cm.

subglobose to broadly ellipsoidal, 5–6.5(–7) x 5.5–7(–8) µm, light olivaceous-brown; wall uniform, ca. 0.5 µm thick, sparsely, finely verrucose, in SEM between the sparse, low warts or spines very finely and densely verruculose. Sterile cells larger than the spores, subglobose to broadly ellipsoidal or slightly irregular, 6–15 x 7–16 µm, single or in smaller or larger, irregular groups, subhyaline, pale yellowish-brown to nearly as dark as the spores; 0.8–1.2 µm thick, smooth.

Sporisorium iseilematis-prostrati differs from the other four smut fungi of *Iseilema* especially by its small spores. The three *Sporisorium* species which destroy all racemes of an inflorescence of *Iseilema* can be distinguished as follows:

- Spores 5.5–7(–8) µm long, sparsely, finely verruculose. *S. iseilematis-prostrati*
- Spores 7–10 µm long, finely echinulate .... *S. iseilematis*
- Spores 9–13.5 µm long, prominently echinulate .... *S. mitchellii*

SYNONYM

***Ustilago sorghi-stipoidei* is *Ustilago ewartii*.**

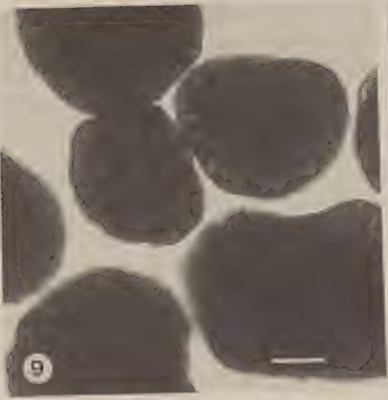
Sorghum stipoideum (Ewart & J. White) C. Gardner & C. E. Hubb. is a grass endemic to the northern parts of Australia. Two smut fungi have been published on this plant. McAlpine (1911(1912):45) described *Ustilago ewartii* McAlpine on *Sarga stipoidea* Ewart & J. White, an older name of this grass. Ling (1953b:154) described *Ustilago sorghi-stipoidei* L. Ling on *Sorghum stipoideum*. These two names represent the same fungus:

Ustilago ewartii McAlpine, 1911(1912):45.

Type on *Sarga stipoidea* Ewart & J. White (= *Sorghum stipoideum* (Ewart & J. White) C. Gardner & C. E. Hubb.), Australia, Western Australia, Kimberley region, Napier, Broome Bay, V.1910, coll. Ewart (BPI 160415).

Ustilago sorghi-stipoidei L. Ling, 1953b:154. — Type on *Sorghum stipoideum* (Ewart & J. White) C. Gardner & C. E. Hubb., Australia, Northern Territory, Katherine, 24.IV.1947, S. T. Blake (BPI 166531!, IMI 43753!).

Sori in some of the ovaries of an inflorescence, swollen, pyriform, with a tapering apex, 5–7 x 10–15 mm, first covered by a thick, dark brown membrane of host origin, which later ruptures disclosing the blackish-brown, powdery mass of spores. Spores globose, subglobose to ellipsoidal, variable in size, 8–12(–14) x 8–14(–15) µm (globose spores 8–14 µm in diameter), olivaceous-brown, densely, prominently echinulate; spines in LM pyramidal, 0.5–1.5 µm high and 0.5–1.5 µm wide at their base. Groups of hyaline, irregular or subglobose fungal cells between the spores are present which, according to McAlpine (1911(1912):45-46), represent immature spores. Spore germination (McAlpine, 1911(1912):46, in water, after a few days) results in septate basidia of variable length on which laterally and terminally numerous fusiform, 3–6 µm long basidiospores are produced, often arranged in chains of three or more.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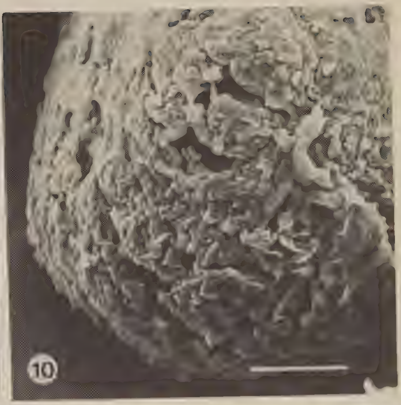
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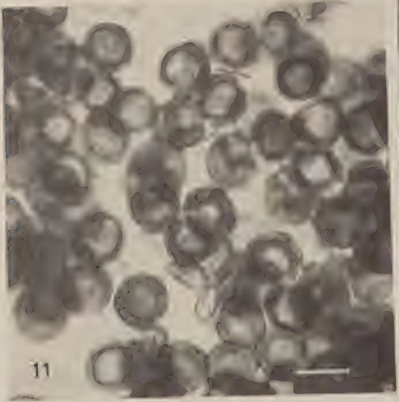
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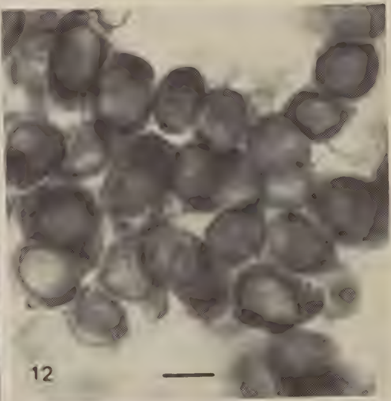
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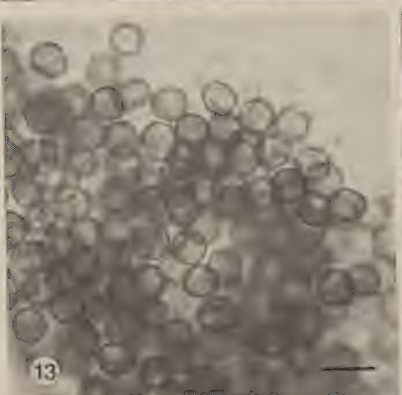
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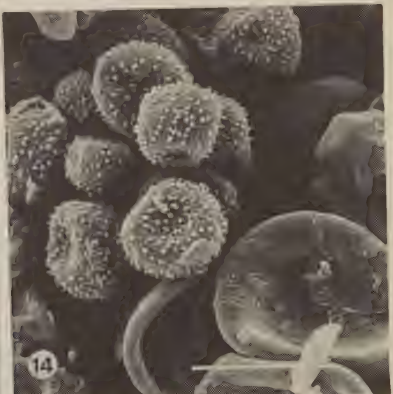
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HOST PLANT

The host plant of *Ustilago dregeana* is a species of *Danthonia* s. lat.

The Tulasne brothers described *Ustilago dregeana* L.-R. & C. Tulasne (1847:83) from South Africa on "Gramen morbosum in Herbario Dregeano no. 9467 includitur, ad promontorium Bonae-Spei lectum", preserved in PC. The sori appear as abundantly ramified, filiform, twisted branches of sterile panicles covered by a black mass of spore powder. Apparently no healthy plants were preserved and the host plant could not be identified. Several mycologists considered the host to be *Cynodon dactylon* (L.) Pers. and, consequently, *Ustilago cynodontis* as a synonym of *U. dregeana*. Zundel (1939:572-575) studied these two smuts and demonstrated that they are two different species. The spores of *U. dregeana* are typical, relatively small (4–7 µm in diam.), provided with large warts or tubercles seen in SEM. Zundel sent a diseased plant to Mrs. Agnes Chase, one of the best grass experts of the world. In 1937, A. Chase wrote to Zundel: "This host is certainly not a species of *Cynodon*". After much work and comparison of leaf sheaths, A. Chase concluded that the host plant of *U. dregeana* could be *Eragrostis porosa* Nees, under which name it is given also in Zundel (1953:156). However, *Eragrostis porosa* does not occur in the Cape Peninsula (comp. Gibbs Russel et al., 1991:157). Recently, in the Cape Peninsula, I collected several smutted grasses showing sorus and spore characters identical with those of *Ustilago dregeana*. The host plants were identified as *Pentaschistis curvifolia* (Schrad.) Stapf (*Danthonia curvifolia* Schrad.), and *Pseudopentameris macrantha* (Schrad.) Conert (*Danthonia macrantha* Schrad.), both belonging to the tribe Danthonieae. Consequently, the host plant of *Ustilago dregeana* must be one of the *Danthonia* s. lat. species, probably one of the numerous *Pentaschistis* or one of the two *Pseudopentameris* species present in the Cape Peninsula.

Figs. 9, 10. Spore balls and hardly visible spores of *Tolyposporium megaglomerulosum* K. Vánky on *Lepidosperma gunnii* Boeck. in LM and in SEM (type).

Fig. 11. Spores of *Melanotaenium indicum* K. Vánky, M. S. Patil & N. D. Sharma on *Ischaemum indicum* (Houtt.) Merrill in LM (type).

Fig. 12. Spores of *Melanotaenium ischaemianum* Thirum. & Pavgi on *Ischaemum semisagittatum* Roxb. in LM (topotype).

Figs. 13, 14. Spores and sterile cells of *Sporisorium iseilematis-prostrati* K. Vánky on *Iseilema prostratum* (L.) Anderss. in LM and in SEM (type).

Bars = 10 µm.

EXCLUDED SPECIES

***Ustilago lupini* is a myxomycete.**

Camara (1949:169) described *Ustilago lupini* Camara from a leaf of *Lupinus luteus* L., Portugal, Pégões, Rabatejo, 17.XII.1948, coll. M. Silva (No. 506), as: "Soris nigris, rotundatis, circa 1 mm. diam., primo epidermide velatis, dein liberis, pulverulentis; sporis globosis, episporio parum crassiusculo (1,3 µ), echinulatis, pallide-fuligineis, 9,5–13 x 9,5–12,5 µ."

The study of the type specimen (LISE 24295) revealed that this fungus is a slime mould. Both surfaces of a small leaflet are covered with sessile, gregarious, pulvinate sporangia of 0.6–0.8 mm diam. Remnants of a thin, silvery peridium around the sporangia can be seen. Between the spores numerous capillitia are present. The epidermis beneath the sporangia is intact.

ACKNOWLEDGEMENTS

I am grateful to Dr. S. Tóth (Gödöllő, Hungary) for providing the Latin descriptions, to Professor emeritus N. Lundqvist (Stockholm, Sweden) and to Dr. R. Berndt (Tübingen, Germany) for reading the manuscript and serving as pre-submission reviewers, to Prof. M. S. Patil (Kolhapur, India) for part of the types of *Melanotaenium arundinellae, M. echinochloae* and *M. tuberculatae*, to Dr. S. Ahmad (Lahore, Pakistan) for the smutted *Boissiera*, and to Dr. D. I Morris (Hobart, Australia) for identifying some host plants. I acknowledge the assistance of Mr. H. Schoppmann and Mr. F. Albrecht (Tübingen, Germany) with SEM and photographic work, respectively. Thanks are also due to the Directors and Curators of the Herbaria BPI, FH, HCIO, HO, IMI, LISE, VPRI and WSP for loans of specimens.

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TAXONOMICAL STUDIES ON USTILAGINALES. XVII. *

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ABSTRACT

The smut fungi of the following grass genera were studied: *Loudetia, Trichopterix, Tristachya, Zonotriche, Danthonia* s. lat., *Merxmuellera, Pentaschistis, Pseudopentameris* and *Schoenefeldia.*

NEW SPECIES proposed: *Macalpinomyces trichopterygis* K. & C. Vánky (type on *Trichopteryx dregeana*, South Africa), *Macalpinomyces tristachyae* K. & C. Vánky (type on *Tristachya leucothrix*, South Africa), *Sporisorium loudetiae-pedicellatae* K. & C. Vánky (type on *Loudetia pedicellata*, South Africa), *Ustilago dregeanoides* K. & C. Vánky (type on *Merxmuellera stricta*, South Africa) and *Ustilago schoenefeldiae* K. Vánky (type on *Schoenefeldia gracilis*, Chad).

NEW COMBINATIONS proposed: *Sporisorium algeriense* (Patouillard) K. Vánky, based on *Cintractia algeriensis* (type on *Danthonia forskalii*), *Sporisorium catinatum* (Zambettakis) K. Vánky, based on *Sphacelotheca catinata* (type on *Tristachya superba*), *Sporisorium decorsei* (Hariot & Patouillard) K. Vánky, based on *Tolyposporium decorsei* (type on *Tristachya superba*), *Sporisorium loudetiae-superbae* (L. Ling) K. Vánky, based on *Sorosporium loudetiae-superbae* (type on *Tristachya superba*), *Sporisorium tristachyae-hispidae* (L. Ling) K. Vánky, based on *Sphacelotheca tristachyae-hispidae* (type on *Tristachya leucothrix*), and *Sporisorium tristachydis* (H. & P. Sydow) K. Vánky, based on *Sorosporium tristachydis* (type on *Tristachya* sp.).

DOUBTFUL smut fungus is: *Ustilago danthoniae* Kalchbrenner.

EXCLUDED SPECIES: Both *Farysia trichopterygis* (Massee) Zundel (type on *Trichopteryx hordeiformis*), and *Sorosporium aristidae-amplissimae* Beeli (type on *Loudetia simplex*) are mitosporic fungi (Fungi Imperfecti), the latter one being a *Ustilaginoidea* sp.

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* Part 143 in the series "Studies in Heterobasidiomycetes" from the Botanical Institute, University of Tübingen.

THE SMUT FUNGI OF *LOUDETIA, TRICHOPTERIX, TRISTACHYA* AND *ZONOTRICHE* (GRAMINEAE).

Members of these closely related grass genera from the tribe Arundinelleae were often placed into one or another of these genera, as can be seen from the great number of synonyms in Clayton et al. (1974). Therefore, I am treating their smut fungi together, irrespectively of the host plant genus in which they were described originally. The following smut fungus names have been published on these genera:
1. *Sorosporium decorsei* (Hariot & Patouillard) L. Ling (based on *Tolyposporium decorsei*), type on *Trichopteryx* aff. *gigantea* (= *Tristachya superba*). 2. *Sorosporium tristachydis* H. & P. Sydow, type on *Tristachya* sp. 3. *Farysia trichopterygis* (Massee) Zundel (based on *Ustilago trichopterygis*), type on *Trichopteryx hordeiformis*. 4. *Sorosporium aristidae-amplissimae* Beeli, type on "*Aristida amplissima* var. *lembaensis*" (= misnamed *Loudetia simplex*). 5. *Macalpinomyces loudetiae* (Viennot-Bourgin) K. Vánky (based on *Sorosporium loudetiae*), type on *Loudetia sp.* (= *L. arundinacea*). 6. *Sphacelotheca tristachyae-hispidae* L. Ling, type on *Tristachya hispida*. 7. *Sorosporium loudetiae-superbae* L. Ling, type on *Loudetia superba*. 8. *Sphacelotheca catinata* Zambettakis, type on *Loudetia superba*. 9. *Macalpinomyces zonotriches* K. Vánky, type on *Zonotriche inamoena*.
Of these, some must be excluded from the smut fungi, others have to be recombined into the genus *Sporisorium*. A few additional species were recently collected in South Africa. Consequently, on the studied host genera the following smut fungi and their synonyms could be recognised:

Sporisorium decorsei (Hariot & Patouillard) K. Vánky, **comb. nov.**

Basionym: *Tolyposporium decorsei* Hariot & Patouillard, Bull. Mus. Hist. Nat. (Paris) 15:197, 1909. – *Sorosporium decorsei* (Hariot & Patouillard) L. Ling, 1953:187. – Type on *Trichopteryx* aff. *gigantea* Stapf (*Loudetia superba* De Not., = *Tristachya superba* (De Not.) Schweinf. & Aschers.), Chad, "Chari, pays Ndonko à Kouti Tété", 2.-18.V.1903, A. J. Decorse, 8276 (PC!).

Sori in ovaries, partly hidden by the floral envelopes, cylindrical, ca. 1.5 x 8–10 mm, first covered by a pale brown peridium which ruptures disclosing the black, granular-powdery mass of spore balls and 1–3 columellae. Spore balls subglobose, ovoid, ellipsoidal to elongated, mostly slightly irregular, 25–40(–50) x 25–65 µm, reddish-brown, loose but rather persistent, composed of 10–40 (or more?) spores. Spores mostly globose, subglobose or ovoid, more rarely subpolyhedral, 7.5–11 x (8–)9–13 µm. Outer spores reddish-brown, wall even, ca. 1 µm thick, evidently, rather densely verruculose-echinulate. Inner spores lighter, thin-walled (ca. 0.5 µm), apparently smooth or very finely punctate. Sterile cells between the spore balls not seen.

On *Tristachya rehmanii* Hack., and *T. superba* (De Not.) Schweinf. & Aschers., C. & S. Africa.

Sporisorium tristachydis (H. & P. Sydow) K. Vánky, **comb. nov.** Basionym: *Sorosporium tristachydis* H. & P. Sydow, Bot. Jahrb. Syst. 45:263, 1911. – *Tolyposporium tristachydis* (H. & P. Sydow) Zundel, 1938:310. – Type on *Tristachya* sp., Cameroun, near Leinde, Garua, XI.1909, coll. Ledermann (BPI 180829! & 192475! as collected on "IV.1909").

Sori in all ovaries of an inflorescence, hidden by the floral envelopes and covered by a light brown peridium which splits longitudinally on several places, revealing the blackish-brown, granular mass of spore balls and a few slender columellae. Spore balls loose but rather permanent, variable in form and size, subglobose, ovoid, elongated or irregular, 30–80 x 40–120 µm, dark reddish-brown, composed of 10–90 (or more?) spores. Spores globose, subglobose to broadly ellipsoidal or ovoid, 11–14(–16) x 12–16(–17) µm. Outer spores dark reddish-brown, wall of the free surface ca. 1 µm thick, sparsely, evidently verrucose-echinulate, spines ca. 0.5–0.8 µm high, wall of the contact sides thicker (ca. 1.5 µm), verrucose. Inner spores lighter coloured, apparently smooth or finely verruculose, wall ca. 0.5 µm thick. Sterile cells between the spore balls not seen.

On *Tristachya* sp., C. Africa (Cameroun, Zaire).

Farysia trichopterygis (Massee) Zundel belongs to the **Fungi Imperfecti.** *Ustilago trichopterygis* Massee, 1911:224. — *Farysia trichopterygis* (Massee) Zundel, 1953:211. — Type on *Trichopteryx hordeiformis* Stapf (= *Loudetia hordeiformis* (Stapf) C. E. Hubb., Nigeria, Lokoja, coll. J. M. Dalziel (276).

According to the original description, the sori develop in the ovaries, dark olivaceous, at first agglutinated then powdery. Spores small, 3.5–4.5 µm in diam., smooth.

I did not see the type specimen. However, the study of the sori and spores of ten Central African collections on different *Loudetia* and *Trichopteryx* species convinced me that this fungus is not a smut. In my opinion it belongs to the mitosporic fungi (Fungi Imperfecti) and should be excluded from the smut fungi.

Sorosporium aristidae-amplissimae Beeli, 1922:7, is a ***Ustilaginoidea*** sp. Type on "*Aristida amplissima* Trin. & Rupr. var. *lembaensis* Vanderyst" (= misnamed *Loudetia simplex* (Nees) C. E. Hubb., det. J. Bosser), Congo [= Zaire], Leopoldville, Kinshasa, VI.1916, leg. R. P. H. Vanderyst (18). Holotype in BR!

This fungus is a *Ustilaginoidea* sp. (Fungi Imperfecti or mitosporic fungus), as also remarked by L. Ling and J. Walker on the herbarium sheath of the type specimen in BR.

Macalpinomyces loudetiae (Viennot-Bourgin) K. Vánky, 1997:130. *Sorosporium loudetiae* Viennot-Bourgin, 1951:104. – *Endosporisorium loudetiae* (Viennot-Bourgin) K. Vánky, 1995:235. – Type on *Loudetia sp.* (= *L. arundinacea* (Hochst. ex A. Rich.) Steud., teste K. Vánky), Cameroun, Ngdéré near Meiganga, VI.1939, coll. Jacques-Félix (PC!).

For its description see Vánky, 1995:235 (sub *Endosporisorium loudetiae*).

On *Loudetia arundinacea* (Hochst. ex A. Rich.) Steud., and *L. flavida* (Stapf) C. E. Hubb., C. and S. Africa.

Sporisorium tristachyae-hispidae (L. Ling) K. Vánky, **comb. nov.**
Basionym: *Sphacelotheca tristachyae-hispidae* L. Ling, Lloydia 16:184, 1953. – Type on *Tristachya hispida* K. Schum. (= *T. leucothrix* Nees), Nyasaland [= Malawi], Lilongwe, II.1951, G. Jackson (IMI 45108!).

Sori in all ovaries of an inflorescence, linear, subcylindrical, 1–1.5 x 8–15 mm, first covered by a thin, greyish-brown peridium of host and fungus origin which ruptures irregularly disclosing the black, first agglutinated, later granular-powdery mass of spore balls and several (3–5), filiform, slender columellae. Infection systemic, all spikelets of an inflorescence being affected. Infected spikelets are awnless. Spore balls subglobose, ellipsoidal, elongated to somewhat irregular, 35–70 x 35–90 µm, reddish-brown, composed of dozens of easily separating spores. Spores usually irregularly subpolyhedral, more rarely broadly ellipsoidal or ovoid, 9–12(–13) x 9.5–15 µm. Outer spores dark reddish-brown, wall of the free surface 1–1.5 µm thick, densely, finely verruculose. Inner spores lighter, thin-walled (ca. 0.5 µm), apparently smooth to finely, densely punctate-verruculose. Sterile cells of the peridium arranged in rows, mostly oblong, occasionally ellipsoidal, 4–9 x 6–12 µm, hyaline

On *Tristachya leucothrix* Nees, C. and S. Africa.

Sporisorium loudetiae-superbae (L. Ling) K. Vánky, **comb. nov.**
Basionym: *Sorosporium loudetiae-superbae* L. Ling, Lloydia 16:190, 1953. – Type on *Loudetia superba* De Not. (= *Tristachya superba* (De Not.) Schweinf. & Aschers.), Nyasaland [= Malawi], Kasupi, 16.VI.1949, P. O. Wiehe 277 (IMI 35741!). Isotype in BPI (180056!).

Sori in ovaries, affecting all the spikelets of an inflorescence, partially protruding through the enveloping glumes, cylindrical, 1.5–2 x 12–16 mm, each enclosed by a greyish peridium which later dehisces irrgularly, exposing a black spore-mass intermixed with 3–5 slender columellae. Spore balls mostly irregular, occasionally subglobose to oblong, evanescent, 50–75 x 60–85 µm, reddish-brown. Spores chiefly polyhedral and more or less elongate, 10–16 x 11–20(–22) µm, occasionally subglobose to ovoid, medium to dark reddish-brown; wall of the free surface ca. 1.5 µm thick (including the up to 1 µm high ornamentation), prominently, densely verrucose-echinulate. Wall of the contact sides and that of the inner spores thinner (0.5–1 µm), from apparently smooth to finely, densely or sparsely punctate-verruculose. Sterile cells not seen.

On *Tristachya superba* (De Not.) Schweinf. & Aschers., C. Africa. Known from the type collection only.

Sporisorium catinatum (Zambettakis) K. Vánky, **comb. nov.**
Basionym: *Sphacelotheca catinata* Zambettakis, Rev. Mycol. (Paris), N. S., 38:81, 1973. — Type on *Loudetia superba* de Not. (= *Tristachya superba* (De Not.) Schweinf. & Aschers.), South Zambia, N. of Kafue, near Shimabala, coll. A. Angus, 1151 (IMI 90030!).

Sori in the ovaries, cylindrical, 2–4 mm wide, up to 15 mm long, partly concealed by the glumes, covered by a light brown peridium which disintegrates at maturity revealing the olivaceous-brown, powdery mass of spores and numerous (10 or more), filiform columellae. Spore balls loose, composed of a great number of easily separating spores. Spores globose or subglobose, rarely ovoid, 6–10 x 6–11 µm, pale olivaceous-brown; wall thin (ca. 0.5 µm), even, sparsely, evidently verrucose-echinulate which just affect the spore profile.

On *Tristachya superba* (De Not.) Schweinf. & Aschers., S. Africa.

There are discrepancies between the French and Latin descriptions, between the descriptions and illustrations of this species in Zambettakis (1973:81, 82, 84) especially regarding the place of sori and the number of columellae. The abowe description is based on the study of the type and other specimens. Sterile cells between the spores not seen. The type locality lies in Zambia, not in Rhodesia as given originally.

Macalpinomyces zonotriches K. Vánky, 1996:122.

Type on *Zonotriche inamoena* (K. Schum.) W. D. Clayton (*Tristachya inamoena* K. Schum.), N. Rhodesia [= N. Zimbabwe], 10.V.1957, A. Angus (IMI 70722!).

For description of the species see Vánky, 1996:122.

Known from only the type collections from C. Africa.

New species, recently collected in South Africa are:

Macalpinomyces trichopterygis K. & C. Vánky, **sp. nov.**

Typus in matrice *Trichopteryx dregeana* Nees, South Africa, Mpumalanga Prov., Drakensberg Mts., cca. 10 km N.E. urbe Graskop, 24°54'25" S, 30°51'56" E, alt. cca. 1680 m, 21.I.1997, leg. C. & K. Vánky. Holotypus in Herbario Ustil. Vánky (HUV 18024), isotypi in PREM, BPI et in Vánky, Ust. exs. (ineditus).

Sori partem distalem culmorum occupantes, eam in tubam filiformem, viridem, pilosam, massa sporarum atrobrunnea, semiagglutinata usque pulverea, cum cellulis sterilibus intermixta impletam transformantes. Sertus sori elongati, albescentes, a parte distali longitudinaliter discissi, sporas ostendentes. In hoc statu sori sicut fascia alba, torta, flagelli- vel vinculiformis, 1–1,5 mm x 5–12 cm longa conspicui. Pars proximalis sororum apertorum propter sporas adhaerentes brunnea, pars basalis autem eorum adhuc crescens tubularis, viridis. Infectio systemica, culmi omnes eiusdem plantae infectae. Plantae infectae non floriferae. Sporae parum irregulares, subpolyedricae, rarius globosae vel ovoideae, 7–10,5 x 8–12 µm, olivaceo- usque rubellobrunneae; pariete aequali, cca. 0,8 µm crasso, leniter, dense punctato-verruculoso. Cellulae steriles in catervis parvis, vel singulae, globosae, subglobosae usque parum irregulares, magnitudine variae, 10–30 x 12–35 µm, hyalinae, guttula una vel guttulis nonnullis (oleae ?); pariete plus-minus aequali, levi, 2,5–3 µm crasso.

Sori (Fig. 1) comprise the distal part of the culms transforming them into a filiform, green, pilose tube filled with a dark brown, semiagglutinated to powdery mass of spores intermixed with sterile cells. With age the sori elongate, turn white, split longitudinally starting from their distal part, disclosing the spores. In this stage the sori are evident as a twisted, whip-like or looped, 1–1.5 mm x 5–12 cm long white bands. The proximal part of the opened sori is brown on one side due to adhering spores. The basal, still growing part of the sori is tubular, green. Infection systemic, all shoots of a plant being affected. Infected plants do not produce flowers. Spores (Figs. 4, 5) slightly irregular, subpolyhedral, more

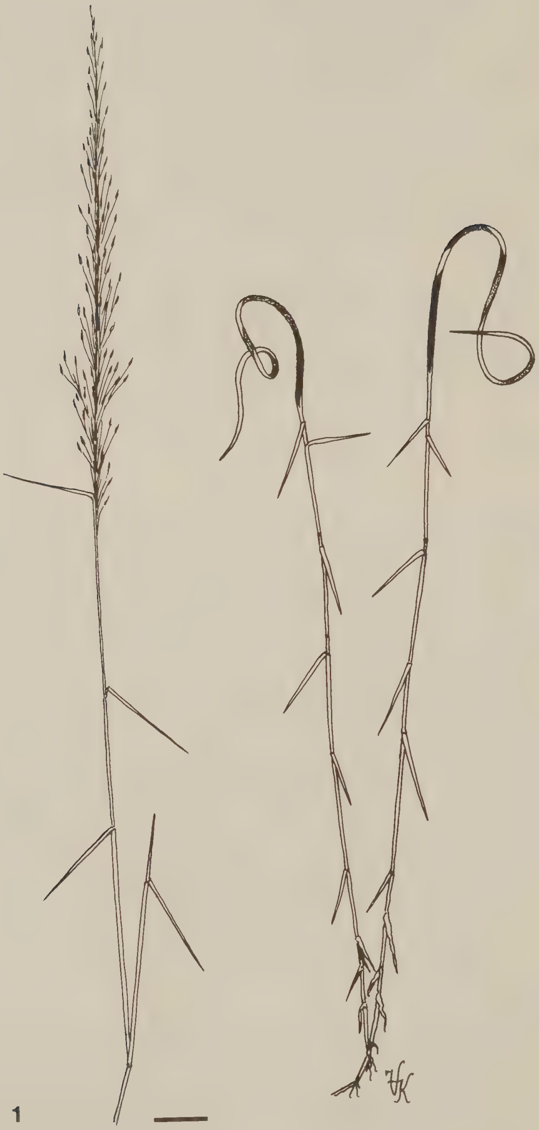


Fig. 1. Sori of *Macalpinomyces trichopterygis* K. & C. Vánky on *Trichopteryx dregeana* Nees. A healthy plant and an infected one with two opened, tubular, twisted sori on the distal part of the shoots (type). Bar = 1 cm.

rarely globose or ovoid, 7–10.5 x 8–12 µm, olivaceous- to reddish-brown; wall uniform, ca. 0.8 µm thick, finely, densely punctate-verruculose. Sterile cells (Figs. 4, 5) in small groups or single, globose, subglobose to slightly irregular, variable in size, 10–30 x 12–35 µm, hyaline, with one to several (oil ?) droplets; wall more or less uniform, 2.5–3 µm thick, smooth.

Known from only the type collection from S. Africa.

Macalpinomyces tristachyae K. & C. Vánky, **sp. nov.**

Typus in matrice *Tristachya leucothrix* Nees, South Africa, KwaZulu-Natal Prov., cca. 20 km E.N.E. urbe Underberg, The Swamp Nature Reserve, 2 km N. oppid. Pevensey, 29°45'50" S, 29°37'06" E, alt. cca. 1550 m, 8.I.1997, leg. C. & K. Vánky. Holotypus in Herbario Ustil. Vánky (HUV 18040), isotypi in PREM, BPI, IMI et in Vánky, Ust. exs. (ineditus). Paratypus: Mpumalanga Prov., cca. 10 km N.E. oppid. Graskop, 24°54'25" S, 30°51'56" E, alt. cca. 1680 m, 21.I.1997, leg. C. & K. Vánky (HUV 18041); isoparatypi in PREM et in BPI.

Sori in parte distali culmi, eam in tubam tenuem, longam, acutam, ex telis hostalibus atque hyphis sporogenicis productam transformantes. Tubae massa sporarum atrobrunnea, agglutinata usque semipulverea, cellulis sterilibus intermixtis impletae. Sori in statu juvenili virides, maturitate elongati, a parte distali longitudinaliter diarupti, post dispersionem sporarum autem in ligamentum pallide albido- vel flavido-brunneum, tortum et flexuosum, 1–2 mm latum, usque ad 15 cm longum transformati. Caules infecti steriles. Sporae irregulariter subpolyedricae, elongatae, casu subglobosae vel ellipsoidales, 5,5–8 x 7–9 µm, rubrobrunneae; pariete inaequali, crassitudine vario, 0,5–1,5 µm crasso, a paene levi usque leviter, dense, uniformiter verruculoso. Cellulae steriles globosae usque late ellipsoidales, 15–30 x 16–35 µm, in catervis parvis dispositae vel singlae, hyalinae; pariete 1–2,5 µm crasso, levi.

Sori (Fig. 2) in the distal part of the culm transforming it into a narrow, long, acute tube formed of host tissues and sporogenous hyphae. The tubes are filled with a blackish-brown, agglutinated to semipowdery mass of spores intermixed with sterile cells. When young the sori are green. At maturity they elongate, split longitudinally from their distal part, the spores are scattered and the sori are transformed into pale whitish- or yellowish-brown, twisted and curled bands, 1–2 mm wide, up to 15 cm long. Infected shoots remain sterile. Spores (Figs. 6, 7) irregularly subpolyhedral, elongated, occasionally subglobose or ellipsoidal, 5.5–8 x 7–9 µm, reddish-brown; wall uneven, of variable thickness, 0.5–1.5 µm wide, from nearly smooth to finely, densely, uniformly verruculose. Sterile cells globose to broadly ellipsoidal, 15–30 x 16–35 µm, in small groups or single, hyaline; wall 1–2.5 µm thick, smooth.

Known from only the type collections from S. Africa.

Sporisorium loudetiae-pedicellatae K. & C. Vánky, **sp. nov.**

Typus in matrice *Loudetia pedicellata* (Stent) Chippind., South Africa, Northern Prov., cca. 20 km S. oppid. Naboomspruit, Nylsvley Nature Reserve, 24°38'39" S, 28°40'30" E, alt. cca. 1250 m, 24.I.1997, leg. C. & K. Vánky. Holotypus in Herbario Ustil. Vánky (HUV 18037), isotypi in BPI, IMI, PREM et in Vánky, Ust. exs. (ineditus).

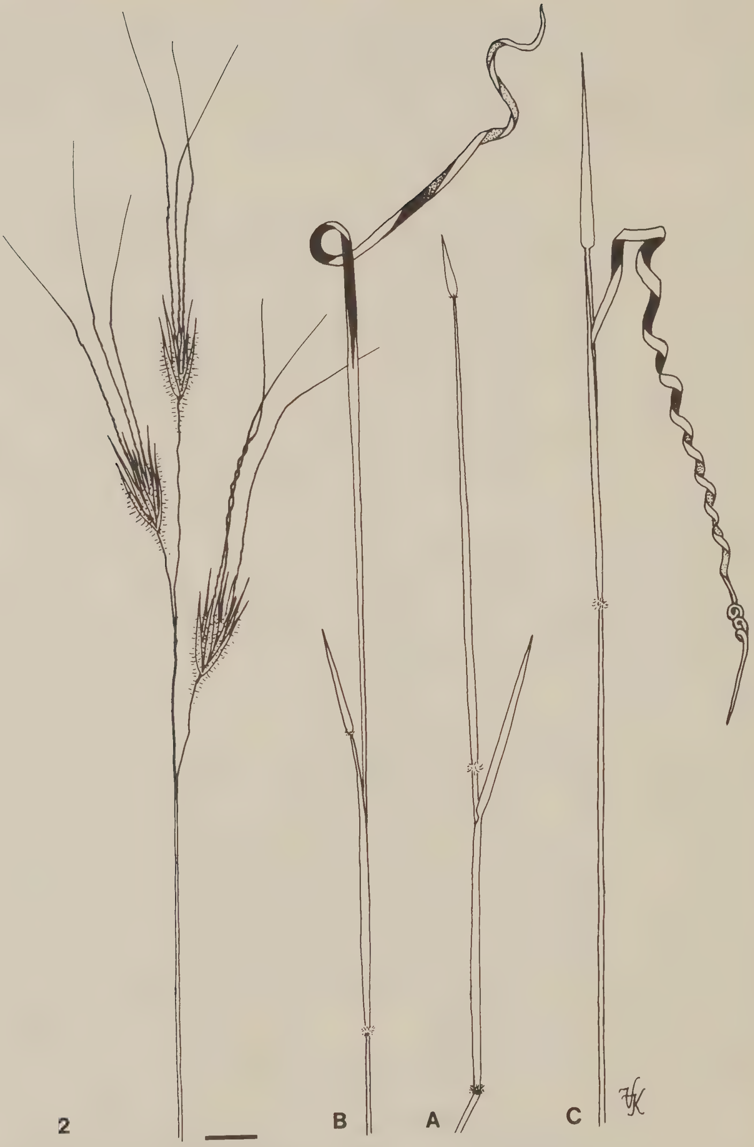


Fig. 2. Sori of *Macalpinomyces tristachyae* K. & C. Vánky on *Tristachya leucothrix* Nees. A. Young sorus hidden by the terminal leaf sheath. B. Opened, well-developed sorus. C. Somewhat old sorus. Left a healthy inflorescence (type). Bar = 1 cm.

Sori inflorescentiam totam occupantes, longe cylindrici, versus apicem tenuiescentes, plerumque inclinati et curvati, 2–10 mm lati, 3–7 cm longi, primo peridio origine fungali et matricali, albido deinde flavido-brunneo vel cinereo cooperti, illo locis nonnullis disrupto massam glomerulorum sporarum et columellarum permultarum, longarum, filiformium ostendentes. Glomeruli sporarum subglobosi, ovoidei, ellipsoidales, elongati vel parum irregulares, (30–)40–90 x (30–)50–100(–140) µm, olivaceobrunnei, opaci, e sporis pluries decem usque pluries centum, facile separabilibus compositi. Sporae roundatae vel elongatae, plerumque irregulariter subpolyedricae, 7–10,5 x 9–13(–14) µm, flavido- usque rubrobrunneae; pariete typice inaequali, 0,5–1,5 µm crasso, leniter, dense, uniformiter punctato-verruculoso, lineam extremam sporae non afficienter. In visu opticali medio partes tenuiores et crassiores parietis sporarum alternantes, illis convenienter areae colore obscuriores et pallidiores conspicuae parietis discernibiles. Cellulae steriles paucae, in catervis irregularibus vel catenatae, verisimiliter origine peridiales. Cellulae singulae forma magnitudineque variae, subglobosae, ellipsoidales, plerumque ad latus unum vel ad latera nonnulla deplanatae, 5–20 µm longae, hyalinae, pariete tenui (cca. 0,5 µm), levi. Sporae cum basidiis(?) pedicelliformibus parvis (2,5–3 x 4–8 µm), in apice basidiosporam unam longam, ellipsoideam, magnitudine (2,5–)3(–3,5) x 20–27 µm producentibus germinantes. Basidiospora hyphas cca. 1,5 µm crassas germinantes.

Sori (Fig. 3) comprising the whole inflorescence, long cylindrical, narrowing towards the apex, usually bent and curved, 2–10 mm wide, 3–7 cm long, first covered by a whitish, later yellowish-brown or grey peridium of fungus and host origin which ruptures longitudinally on several places disclosing the dark brown mass of spore balls and a great number of long, filiform columellae. Spore balls (Figs. 8, 9) subglobose, ovoid, ellipsoidal, elongated or slightly irregular, (30–)40–90 x (30–)50–100(–140) µm, olivaceous-brown, opaque, composed of dozens to hundreds of easily separating spores. Spores (Figs. 8, 9) rounded or elongated, usually irregularly subpolyhedral, 7–10.5 x 9–13(–14) µm, yellowish- to reddish-brown; wall typically uneven, 0.5–1.5 µm thick, finely, densely, uniformly punctate-verruculose which does not affect the spore profile. In optical median view, thinner and thicker parts of the spore wall are alternating. Correspondingly, somewhat darker and lighter areas can be distinguished in the spore colour. Sterile cells few, in irregular groups or in chains, probably originating from the peridium. Single cells variable in shape and size, subglobose, ellipsoidal, usually flattened on one or several sides, 5–20 µm long, hyaline, wall thin (ca. 0.5 µm), smooth. Spore germination (Fig. 10; on WA, at room temp., in 1 day) results in small (2.5–3 x 4–8 µm), pedicel-like basidia(?) on which apically a long, ellipsoidal basidiospore is produced, measuring (2.5–)3(–3.5) x 20–27 µm. The basidiospores germinate giving rise to ca. 1.5 µm thick hyphae.

Known from the type collection only.

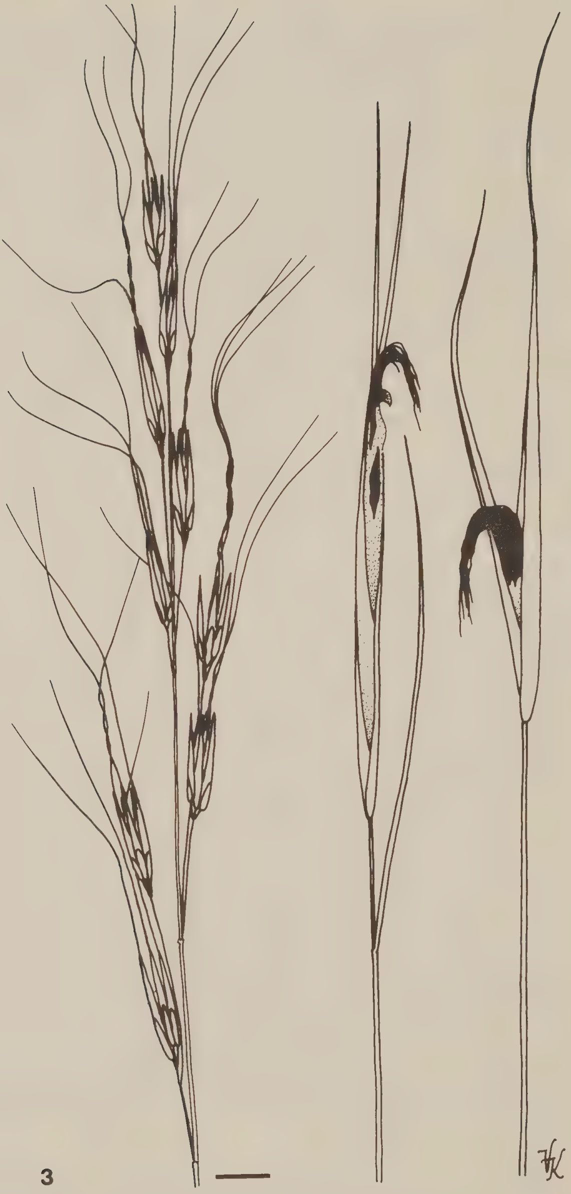
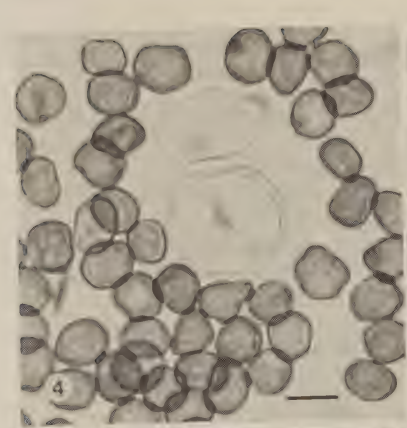


Fig. 3. Sori of *Sporisorium loudetiae-pedicellatae* K. & C. Vánky on *Loudetia pedicellata* (Stent) Chippind., and a healthy inflorescence (type). Bar = 1 cm.

Key to the smut fungi of *Loudetia, Trichopterix, Tristachya* and *Zonotriche.*

1. Sori in the distal part of the stems as long tubes, later as twisted bands 2
– Sori elsewhere 3
2. Spores 7–9 µm long. Wall of sterile cells 1–2.5 µm thick .... *Macalpinomyces tristachyae*
– Spores 8–12 µm long. Wall of sterile cells 2.5–3 µm thick .... *Macalpinomyces trichopterygis*
3. Sori comprise the whole inflorescence.......... *Sporisorium loudetiae-pedicellatae*
– Sori do not comprise the whole inflorescence 4
4. Giant (14–30 µm long), thick-walled (4–7 µm) sterile cells present between the spores. Sori in some ovaries of an inflorescence .... *Macalpinomyces zonotriches*
– Giant, thick-walled sterile cells absent..........5
5. Sori comprise the central part of the spikelets and are tubular, filiform, later twisted or looped bands, 4–6 cm long, columella and true spore balls absent.......... *Macalpinomyces loudetiae*
– Sori restricted to the ovaries, not as above, shorter, columellae present. Spore balls, though sometimes evanescent, present..........6
6. Spores 11–22 µm long, irregular, free surface prominently, densely verrucose-echinulate, spines up to 1 µm high.......... *Sporisorium loudetiae-pedicellatae*
– Spores smaller, less irregular, free surface less prominently or only sparsely ornamented..........7
7. Spores 12–17 µm long, free surface sparsely verrucose-echinulate, spines up to 1 µm high.......... *Sporisorium tristachydis*
– Spores smaller 8
8. Columellae numerous (10 or more). Spores 6–11 µm long, sparsely, evidently verrucose.......... *Sporisorium catinatum*
– Columellae few (1–3–5). Spores larger..........9
9. Spore balls 25–65 µm long, rather persistent. Spores mostly globoid, 8–13 µm long.......... *Sporisorium decorsei*
– Spore balls 35–90 µm long, easily disintegrating. Spores mostly irregular, 9.5–15 µm long.......... *Sporisorium tristachyae-hispidae*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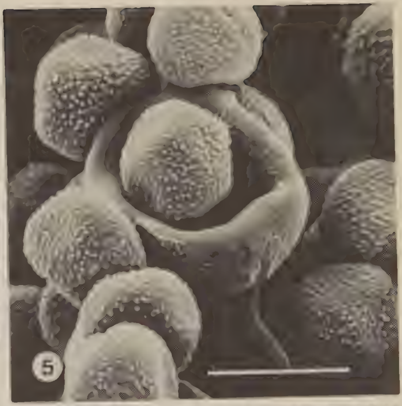
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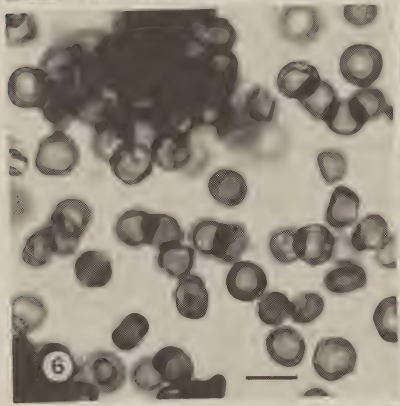
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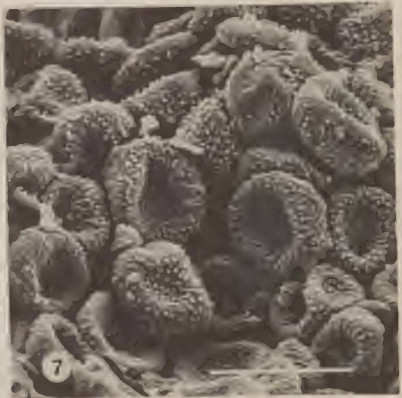
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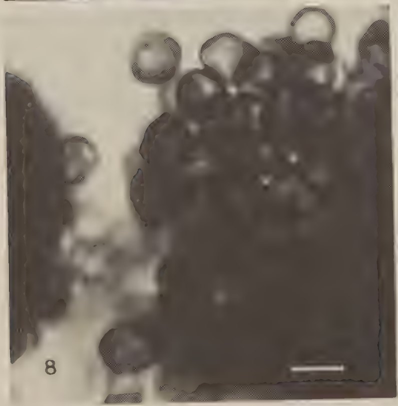
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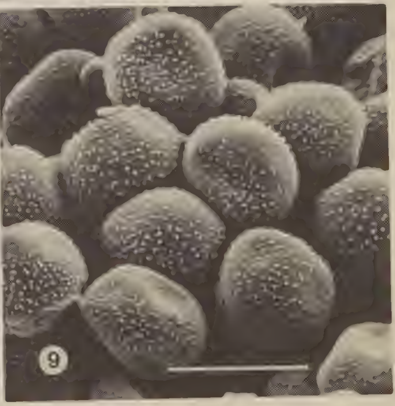
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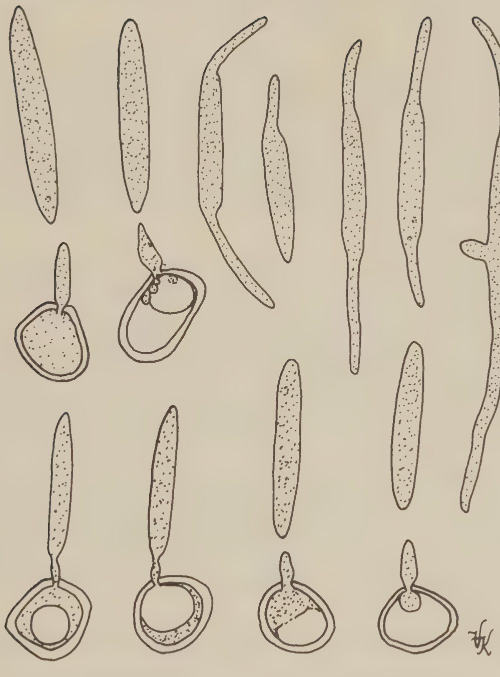

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Fig. 10. Germinating spores of *Sporisorium loudetiae-pedicellatae* K. & C. Vánky (on WA, at room temp., in 1 day). On short, pedicel-like basidia(?) long, subnaviculiform basidiospore is produced which germinate by hyphae (type). Bar = 1 cm.

Figs. 4, 5. Spores and sterile cells of *Macalpinomyces trichopterygis* K. & C. Vánky on *Trichopteryx dregeana* Nees in LM and in SEM (type).

Figs. 6, 7. Spores and sterile cells of *Macalpinomyces tristachyae* K. & C. Vánky on *Tristachya leucothrix* Nees in LM and in SEM (type).

Figs. 8, 9. Spore balls and spores of *Sporisorium loudetiae-pedicellatae* K. & C. Vánky on *Loudetia pedicellata* (Stent) Chippind. in LM and in SEM (type). Bars = 10 µm.

THE SMUT FUNGI OF *DANTHONIA* S. LAT. AND SOME CLOSELY RELATED GENERA (GRAMINEAE).

Danthonia (*Sieglingia*) s. lat., including *Rytidosperma* (*Nothodanthonia, Erythranthera*) and *Centropodia* (*Astenatherum*) is a large, heterogeneous genus of ca. 125 species from both hemispheres. Its classification is still not satisfactorily solved. Closely related genera are, i.a., *Merxmuellera, Pentaschistis* and *Pseudopentameris* (subfam. Arundinoideae, tribe Danthonieae). On these several smut fungi have been published or collected recently. The following names are known:

1. *Ustilago dregeana* L.-R. & C. Tul., type on "gramen morbosum" (= *Danthonia* s. lat. sp.), S. Africa. **2**. *Ustilago danthoniae* Kalchbr., type on *D. papposa*, S. Africa. **3**. *Ustilago comburens* Ludwig, type on "*Stipa* sp." (= *Danthonia* sp.), Australia. **4**. *Ustilago microspora* Massee & Rodway, type on *D. penicillata*, Australia. **5**. *Cintractia algeriensis* Pat., type on *D. forskalii*, Algeria. **6**. *Ustilago residua* G. P. Clinton, type on *D. compressa*, USA. **7**. *Ustilago exigua* H. & P. Sydow, type on *D. penicillata*, Australia. **8**. *Ustilago agropyri* McAlp., type on "*Agropyron scabrum*" (= *D. penicillata*), Australia. **9**. *Ustilago readeri* H. & P. Sydow ex McAlp., type on "*Agropyron scabrum* Beauv." (= *D. penicillata*), Australia. **10**. *Ustilago segetum* Persoon f. *danthoniae* Ell. & Ev., type on *D. compressa*, USA. **11**. *Ustilago striiformis* (Westend.) Niessl, lectotype on *Holcus lanatus*, Belgium. **12**. *Tilletia airae* Blytt (= *T. cerebrina* Ell. & Ev.) type on *Deschampsia cespitosa*, Norway.

Of these the following species and their synonyms could be recognised:

Ustilago dregeana L.-R. & C. Tulasne, 1847:83.

Type on "Gramen morbosum" (= *Danthonia* s. lat., teste K. Vánky), South Africa, Western Cape Prov., Cape of Good Hope, coll. Drege (9467; PC!).

Sori in the whole inflorescence which is transformed into a naked, blackish-brown, powdery mass of spores, first protected by the terminal leaf sheath, later exposed, the spores are scattered and the sori appear as abundantly ramified, filiform, twisted branches of the sterile panicle covered by spore remnants. Peridium around the sori and sterile cells between the spores are lacking. Spores (Figs. 14, 15) globose, subglobose to ellipsoidal, 4.5–6.5 x 5–6.5(–7) µm, olivaceous-brown, provided with large tubercles. Spore germination (Fig. 19; on WA, at room temp., in 2 days) results in septate basidia (in 3 + 1 arrangement) on which ovoid basidiospores are produced laterally and terminally measuring ca. 1.5 x 2.5–3 µm or, after fusion of two basidial cells, ca. 0.5 µm wide, long hyphae arise.

On *Pentaschistis curvifolia* (Schrad.) Stapf (*Danthonia curvifolia* Schrad.), *Pseudopentameris macrantha* (Schrad.) Conert (*Danthonia macrantha* Schrad.), and *Danthonia* s. lat. sp., South Africa.

The host plant of the type of *Ustilago dregeana* is neither *Cynodon dactylon* (L.) Pers., nor *Eragrostis porosa* Nees, as was given earlier, but it is a *Danthonia* s. lat. species (comp. Vánky, in press).

Ustilago danthoniae Kalchbrenner is a **doubtful smut**.

Kalchbrenner (1882:18) described *Ustilago danthoniae* Kalchbr., with type on *Danthonia papposa* Nees (= *Merxmuellera papposa* (Nees) Conert) from South Africa.

The original description given by Kalchbrenner (1882:18) is very short and incomplete: "Sporis globosis, 0.036 mm. diam., granulosis, atro-fuscis. In spicibus *Danthoniae papposae* Nees. In summo monte Chumiberg, prope stationem Missionis evangelicae 'Lovedale' dictam, leg. Rev. T. Buchanan." (Spores globose, 36 µm diam., granular, dark brown. In the spikes of *Danthonia papposa* Nees. On the top of Chumiberg Mt., near the station of the Evangelical Mission 'Lovedale', coll. by Rev. T. Buchanan). Furthermore, Kalchbrenner wrote that *U. danthoniae* is rather close to *U. salveii* Cooke [= *U. striiformis* (Westend.) Niessl], in which species the sori are in the leaves forming striae.

Zundel (1953:155) remarks that "A good description of this species has never been published and no specimen could be found either at the Royal Botanic Gardens, Kew, or the Department of Agriculture, Pretoria [= PREM]. No one seems to know where the type specimen is deposited". It was neither found in Budapest, where many specimens of Kalchbrenner are preserved (Dr. J. Gönczöl, BP, pers. comm.).

Regarding the locality of the type collection, Zundel (1953:155) placed it into Abyssinia. Against this placement speaks the fact that Buchanan was collecting in South Africa. Furthermore, the host plant is endemic to a restricted region in South Africa (Eastern Cape Prov., Uitenhage area; comp. Gibbs Russel et al., 1991:217). According to Dr. C. Roux (PREM, in litt.), "Lovedale is near Alice in the Eastern Cape Prov. The mountain is far away and called the Amatolas or Hogsback mountains". Indeed, this place is rather close to Uitenhage.

The large spore measurements of 36 µm are not typical for an *Ustilago*. If described accurately, Kalchbrenner's fungus probably is not a smut. The study of the type specimen is necessary to solve this problem.

Ustilago comburens Ludwig, 1893:139.

Type on "*Stipa* sp." (= misnamed *Danthonia* sp.), Australia, South Australia, Murray Bridge, 10.XII.1892, J. G. O. Tepper.

Ustilago microspora Massee & Rodway, in Massee, 1901:160 (later homonym, not Schröter & P. Henn., in Hennings, 1896). – Type on *Danthonia penicillata* (Labill.) R. Br. ex Beauv., Australia, Tasmania, coll. L. Rodway.

Ustilago exigua H. & P. Sydow, 1903:177. (nom. nov. for *Ustilago microspora* Massee & Rodway, not Schröter & P. Henn.). – Type on *Danthonia penicillata* (Labill.) R. Br. ex Beauv., Australia, Tasmania, coll. L. Rodway.

Sori destroying the inflorescence of which only the rachis is left behind which is covered by an olivaceous-brown, powdery mass of spores intermixed with ramifying, irregular fibres of host origin. Spores globose, ovoid, ellipsoidal to slightly irregular, 2.5–3.5 x 2.5–4.5(–5) µm, light olivaceous-brown, smooth. Germination (of 3 months old spores, on water, after 9 days) resulted in ca. 6 µm long, one-septate basidia (McAlpine, 1910:154).

On *Danthonia buchananii* Hooker fil., *D. caespitosa* Gaudisch., *D. penicillata* (Labill.) R. Br. ex Beauv., *D. pilosa* R. Br., *D. setacea* R. Br., *Rytidosperma pumilum* (Kirk) Clayton & Renvoize, Australia and New Zealand.

Sporisorium algeriense (Patouillard) K. Vánky, **comb. nov.**

Basionym: *Cintractia algeriensis* Patouillard, Bull. Soc. Mycol. France 18:48, 1902. – *Sphacelotheca algeriensis* (Pat.) Ciferri, 1928:32. – Type on *Danthonia forskalii* (Vahl) R. Br., Algeria, Biskra, IV.1895, N. Patouillard (FH!).

Sori in the inflorescence destroying it completely, ca. 0.5 x 2–4 cm, first protected by leaf sheaths and covered by a whitish peridium which ruptures irregularly disclosing the first agglutinated later powdery mass of loose spore balls and spores intermixed with groups of sterile cells and an irregular, central columella of the length of the sorus. Spore balls large, irregular, composed of hundreds of easily separating spores. Spores globose, subglobose to broadly ellipsoidal, 5–7 x 5.5–7.5 µm, reddish-brown; wall even, ca. 0.5 µm thick, finely, moderately densely punctate. Sterile cells globose, subglobose, ellipsoidal or with flattened contact sides, 8–15 µm long, in loose, irregular groups of a few to dozens of cells, hyaline; wall ca. 1 µm thick, smooth.

On *Danthonia forskalii* (Vahl) R. Br. (*Astenatherum forskalii* (Vahl) Nevski, *Centropodia forskalii* (Vahl) Cope), and *Danthonia fragilis* Guinet & Sauvage (*Astenatherum fragile* (Guinet & Sauvage) Monod), North Africa (Algeria).

When Patouillard (1902:48) described this fungus, he probably had young, immature, hard sori with still agglutinated spore masses at his hand. Hence his placement of this smut into the genus *Cintractia*. Recently, I have seen mature sori on *Danthonia fragilis* from Algeria, on which I completed Patouillard's description.

Ustilago residua G. P. Clinton, 1902:133.

Based on *Ustilago segetum* Persoon forma *danthoniae* Ellis & Everhart, in Ellis & Ev., N. Amer. fgi. No. 1893a, 1887 (not *U. danthoniae* Kalchbrenner). – Type on *Danthonia compressa* Austin, USA, New York (n. v.); according to Zundel (1953:195), the type is from USA, New Hampshire, North Woodstock (n. v.).

Sori in the whole or sometimes only in a part of the inflorescence (in the inflorescence axis or only in individual spikelets) destroying them, but often also in the leaf-sheaths and leaf blades which partly enclose the inflorescence. In these the fungus produces long, bullate, often confluent pustules or streaks, first covered by the epidermis which ruptures disclosing the dark brown semiagglutinated to powdery mass of spores permeated by irregular fibres of host origin. In the leaves the fungus destroys the tissues between the veins and the leaves become shredded, often with an intact distal part. Spores globose, subglobose to broadly ellipsoidal, 7–9.5 x 8–10(–11) µm, olivaceous-brown; wall even, ca. 1 µm thick including the low warts which are grouped into small, irregular clusters composed of 2–5 or more warts, giving an irregular, granular-reticulate appearance to the spore surface.

On *Danthonia californica* Boland. (*D. americana* Scribn.), *D. compressa* Austin, *D. intermedia* Vasey, *D. parryi* Scribn., *Danthonia riabuschinskii* (Kom.) Kom., *D. spicata* (L.) Beauv. ex Roemer & Schultes, *D. unispicata* (Thurb.) Munro ex Macoun, North America and East Asia (Kamchatka).

In the original description, the spore measurements given by Clinton (1902:133) are "usually 5.5–8.5 µ, sometimes even 11 µ in length".

Ustilago agropyri McAlpine, 1896:154.

Type on *Agropyron scabrum* Beauv. (= misnamed *Danthonia penicillata* (Labill.) R. Br. ex Beauv., comp. McAlpine, 1910:169-160), Australia, Victoria, Ardmona, X-XII.1892, G. H. Robinson (128).

Ustilago readeri H. & P. Sydow ex McAlpine, 1910:159. Nomen novum superfluum for *Ustilago agropyri* McAlpine.

Sori in stems, leaves and inflorescence. In stems and leaves as shorter or longer subepidermal pustules or bullate streaks. The inflorescence may be completely or partly destroyed. In the last case, especially the proximal part of the floral axis is affected or the whole axis and the basal part of the spikelets are comprised whereas the distal part of the glumes is intact. Sori first covered by the epidermis as a silvery or lead coloured membrane which ruptures irregularly disclosing the black, semiagglutinated mass of spores. Spores globose, subglobose, broadly ellipsoidal to slightly irregular, (8–)9–12 x 9.5–13.5 µm, dark reddish-brown; wall relatively thick (0.8–1.5 µm), moderately densely, finely echinulate which not or only just affects the spore profile. Germination (on MYP, at room temp., within one day) results in one or two, 2–4-celled basidia producing ellipsoidal basidiospores apically and laterally, on short sterigmata.

On *Danthonia auriculata* J. M. Black, *D. penicillata* (Labill.) R. Br. ex Beauv., *D. pilosa* R. Br., *D. racemosa* R. Br., and *D. semiannularis* R. Br., Australia and New Zealand.

The wide host spectrum of ***Ustilago striiformis*** (Westend.) Niessl (lectotype on *Holcus lanatus*, Belgium) comprises a great number of grasses belonging to most different genera. I did not see this smut on *Danthonia* (*Sieglingia*) but there is no reason to doubt its occurrence also on this host genus. (For its description and illustration see Vánky, 1994:377, 435, 436).

Tilletia airae Blytt (= *T. cerebrina* Ell. & Ev.; type on *Deschampsia cespitosa* (L.) Beauv., Norway), was reported from USA on *Danthonia danthonioides* (Trin.) Munro (comp. Zundel, 1953:281). However, this report refers to the host plant *Deschampsia danthonioides* (Trin.) Munro ex Benth.

The name of an additional smut fungus, ***Ustilago sieglingiae*** Ricker, 1905:112, suggests the idea that this fungus may belong to the group of *Danthonia* smuts. It was described on a *Sieglingia*, the older name of the conserved *Danthonia* (type on *Sieglingia purpurea* (Walt.) Kuntze = *Triplasis purpurea* (Walt.) Chapm., USA). However, the host plant, *Triplasis purpurea*, belonging to the subfam. Chloridoideae, tribe Eragrostideae, subtribe Eleusininae is not related to *Danthonia* (subfam. Arundinoideae, tribe Danthonieae).

A smut looking like *Ustilago dregeana* but possessing different spore morphology (comp. Figs. 12 – 15) was recently collected in South Africa:

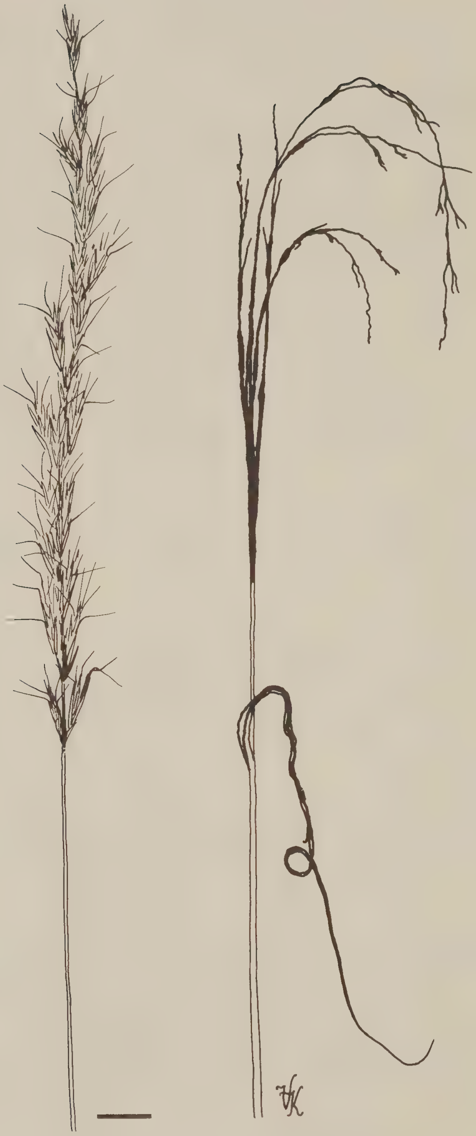


Fig. 11. Sori of *Ustilago dregeanoides* K. & C. Vánky in the inflorescence and also in the uppermost leaf of *Merxmuellera stricta* (Schrad.) Conert (type). Left a healthy inflorescence. Bar = 1 cm.

Ustilago dregeanoides K. & C. Vánky, **sp. nov.**

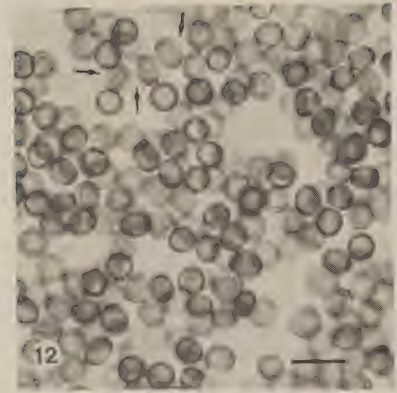
Typus in matrice *Merxmuellera stricta* (Schrad.) Conert (*Danthonia stricta* Schrad., det. L. Fish, PRE), South Africa, Western Cape Prov., 13 km S.E. urbe Stellenbosch, Jonkershoek Mts., Boland Trail, near Kleinplaas Dam, 38°59'22" S, 18°57'18" E, alt cca. 360 m, 6.XII.1996, leg. C. & K. Vánky. Holotypus in Herbario Ustil. Vánky (18050), isotypi in PREM, BPI et in Vánky, Ust. exs. (ineditus).

Sori sicut in *Ustilago dregeana*, inflorescentiam totoam in massam pulveream, nudam sporarum transformantes et post dispersionem sporarum ramulos steriles, filiformes, contortos paniculi residuis sporarum coopertos relinquentes. Sori raro etiam strias longas foliorum supremorum formantes quibus ruptis etiam folia dissoluta. Sporae globosae usque ellipsoidales, (4,5–)5–6 x 5–6,5 µm, olivaceo-brunneae, cum areis polaribus duobus pariete tenuioribus (cca. 0,5 µm crassis) et parum pallidioribus quam partes ceterae sporarum (pariete cca. 0,8 µm crasso). Superficies sporarum modice dense, conspicue verrucosa, propter hoc linea extrema sporarum leniter undulata vel serrulata, praesertim in areis polaribus, apparens, sub SEM humiliter tuberculata.

Sori (Fig. 11), as in *Ustilago dregeana*, in the whole inflorescence which is transformed into a naked, blackish-brown, powdery mass of spores which are dispersed leaving behind the naked, filiform, twisted branches of the sterile panicle covered by spore remnants. Sori rarely also in the uppermost leaves as long striae which rupture and the leaves become shredded. Spores (Figs. 12, 13) globose to ellipsoidal, (4.5–)5–6 x 5–6.5 µm, olivaceous-brown, with two polar areas where the wall is thinner (ca. 0.5 µm thick) and slightly lighter than in the rest of the spore (with ca. 0.8 µm thick wall). Spore surface in LM moderately densely, evidently verrucose which causes the spore profile to appear finely wavy or serrulate, especially in the polar areas, in SEM low tuberculate.

Key to the smut fungi of *Danthonia* s. lat.

1. Sori only in the leaves as long striae. Spores 9–16 µm long, finely to prominently echinulate .... *Ustilago striiformis*
– Sori in the inflorescence, rarely also in the uppermost leaves 2
2. Peridium, columella, spore balls and sterile cells present .... *Sporisorium algeriense*
– Peridium, columella, spore balls and sterile cells absent 3
3. Spores 2.5–5 µm long, smooth .... *Ustilago comburens*
– Spores larger, ornamented 4
4. Spores 5–7 µm long...5
– Spores larger 6
5. Spores in LM tuberculate, without thinner polar areas .... *Ustilago dregeana*
– Spores in LM verrucose, with two, thinner polar areas ... *Ustilago dregeanoides*
6. Spores 8–11 µm long, evidently, irregularly verrucose .... *Ustilago residua*
– Spores 9.5–13.5 µm long, finely, regularly echinulate .... *Ustilago agropyri*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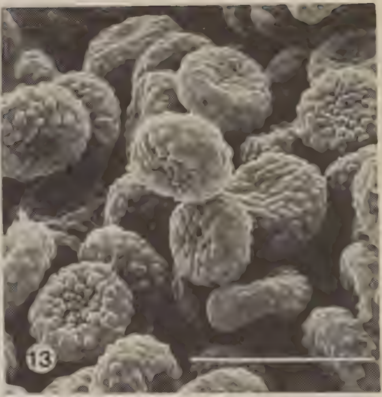
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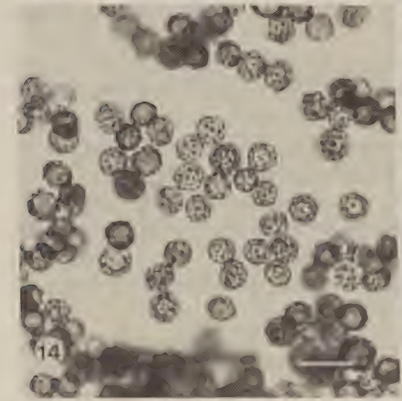
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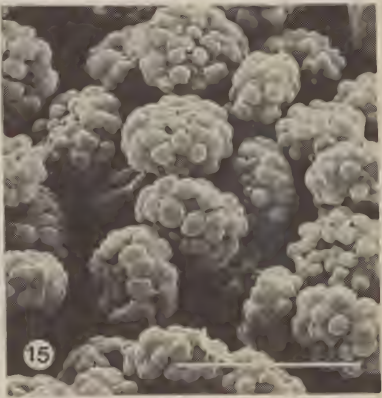
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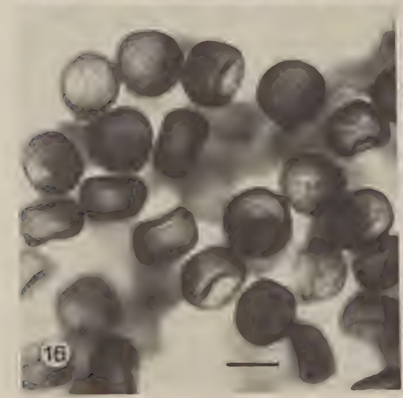
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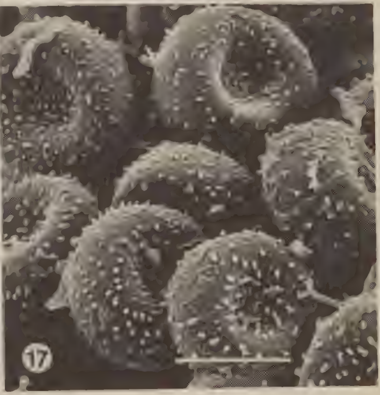
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A SMUT FUNGUS OF *SCHOENEFELDIA* (GRAMINEAE).

Schoenefeldia is a somewhat isolated genus of two species related to *Chloris* (subfam. Chloridoideae, tribe Cynodonteae, subtribe Chloridinae), in Africa, Madagascar and India (Clayton & Renvoize, 1986:244). No smut fungus was yet published on it. In my smut fungus herbarium there is an unidentified collection which is described here as:

Ustilago schoenefeldiae K. Vánky, **sp. nov.**

Typus in matrice *Schoenefeldia gracilis* Kunth, Chad, cca. 50 km N. urbe Abéché, 30 km S. pag. Biltine, 9.X.1935, leg. M. Murat (26). Holotypus in Herbario Ustilag. Vánky (HUV 11605).

Sori in inflorescentia, spiculas et spicas destruentes, axem spicarum massa sporarum nigrobrunnea, semiagglutinata cooperientes. Axis tantum spicarum aliquando simul cum involucris floralibus nonnullis deformatis et aristis relicti. Sporae globosae, subglobosae usque late ellipsoidales, parum deplanatae, 11–13 x 12–14(–15) µm, e latere 9–13 µm latae, atro-rubrobrunneae; pariete aequali, 1(–1,5) µm crasso, disperse usque moderate dense echinulato, spinis cca. 0,5 µm altis.

Sori (Fig. 18) in the inflorescence destroying the spikelets and spikes covering the axis of the spikes with a blackish-brown, semiagglutinated mass of spores. Only the axis of the spikes is left behind, sometimes with a few, deformed floral envelopes and awns. Spores (Figs. 16, 17) globose, subglobose to broadly ellipsoidal, slightly flattened, 11–13 x 12–14(–15) µm, laterally 9–13 µm wide, dark reddish-brown; wall even, 1(–1.5) µm thick, sparsely to moderately densely echinulate, spines ca. 0.5 µm high.

Figs. 12, 13. Spores of *Ustilago dregeanoides* K. & C. Vánky on *Merxmuellera stricta* (Schrad.) Conert in LM and in SEM (type). Remark the finer ornamentation in comparizon with figs. 14, 15, and also the lighter polar areas in fig. 12 (arrows).

Figs. 14, 15. Spores of *Ustilago dregeana* L.-R. & C. Tulasne on *Pentaschistis curvifolia* (Schrad.) Stapf in LM and in SEM (South Africa, Cape Town, Table Mt., 9.XII.1996, coll. C. & K. Vánky, HUV 18038).

Figs. 16, 17. Spores of *Ustilago schoenefeldiae* K. Vánky on *Schoenefeldia gracilis* Kunth in LM and in SEM (type). Bars = 10 µm

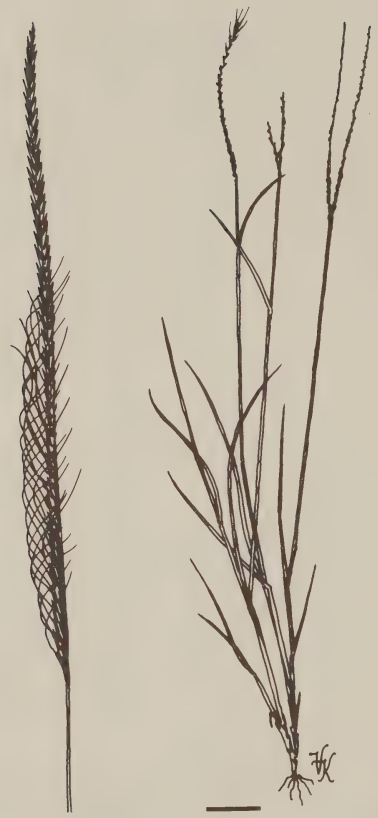

Fig. 18. Sori of *Ustilago schoenefeldiae* K. Vánky in the spikes of *Schoenefeldia gracilis* Kunth (type). Left a healthy inflorescence. Bar = 1 cm.

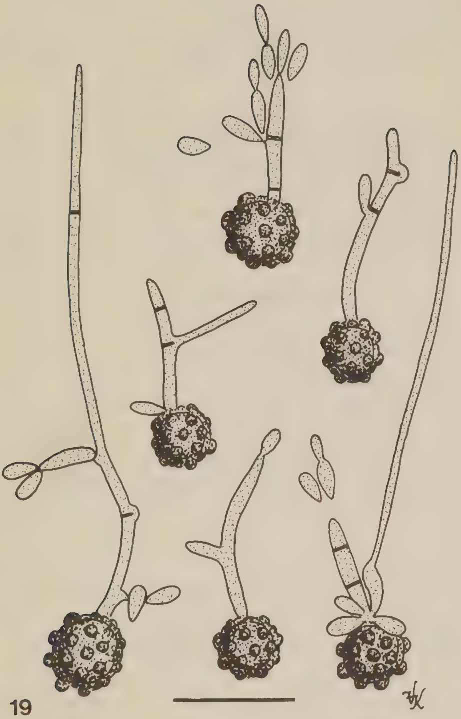

Fig. 19. Germinating spores of *Ustilago dregeana* L.-R. & C. Tul. (on WA, at room temp., in 2 days; from *Pentaschistis curvifolia* (Schrad.) Stapf, South Africa, Cape Town, Table Mt., 9.XII.1996, coll. C. & K. Vánky, HUV 18038).
Bar = 10 μm

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WEBSDANEA, A NEW GENUS OF SMUT FUNGI. *

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ABSTRACT

The study of the peculiar *Ustilago lyginiae* of *Lyginia barbata* (Restionaceae) from Australia, resulted in the description of a monotypic genus: *Websdanea* K. Vánky, type *W. lyginiae* (Websdane, Sivasithamparam, Dixon & Pate) K. Vánky, comb. nov.

INTRODUCTION

The monocotyledonous Restionaceae is a remarkable family of Southern Hemisphere, evergreen, rush-like plants. Some 400 species in about 40 genera are known (Linder, 1985). These are concentrated mainly in SW Africa (ca. 320 species) and in SW Australia (over 115 species in 28 genera; Meney, 1993). On these more than 400 species only four smut fungi have been described, all from Australia. One of these is the peculiar *Ustilago lyginiae* Websdane, Sivasithamparam, Dixon & Pate, on the culms of *Lyginia barbata* R. Br. which I recently collected and studied.

MATERIALS AND METHODS

Smutted *Lyginia barbata* R. Br. were collected in Australia, Western Australia, Augusta Margaret River Distr., 35 km SSW Dunsborough, 6.II.1996, K. Websdane, C. & K. Vánky (PERTH, HUV 17819, also distributed in Vánky, Ust. exs. No. 996 as *Ustilago lyginiae*); Western Australia, Marsengo Park, Bateman, 4.I.1994, K. Websdane (PERTH, HUV 16361).

For studies of the soral characters, fresh material was fixed with 2% glutaraldehyde in 0.1 M Na-cacodylate buffer at pH 7.2 for several days. After six transfers in 0.1 M Na-cacodylate buffer, the material was postfixed in 1% osmiumtetroxide in the same buffer for 1 h in the dark, washed in distilled water, and stained in 1% aqueous uranyl acetate for 1 h in the dark. After five washes in distilled water, the material was dehydrated in acetone series, embedded in Spurr's plastic and sectioned with a diamond knife. Semi-thin sections were stained with new fuchsin and crystal violet, mounted in "Entellan" and studied in a light microscope.

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* Part 144 in the series "Studies in Heterobasidiomycetes" from the Botanical Institute, University of Tübingen.

For light microscopical (LM) studies, dried spore balls and spores were rehydrated in lactophenol by gently heating to boiling point under a cover glass. For scanning electron microscopical (SEM) studies, dried spore balls were dusted on double-sided adhesive tape, mounted on specimen stub, sputter-coated with gold-palladium, ca. 20 nm, and examined in a SEM at 10 kV.

For the study of germination, spores were spread thinly on water agar (WA) in Petri dishes kept at room temperature (ca. 22 °C). To prevent contamination of the media during germination, the spore masses were pre-treated with a 0.01 % solution of Amisept (di-isobutyl phenoxyethyl dimethyl-ammonium chloride; as recommended by Kukkonen & Hyytiäinen, 1969) for 20 mins., washed with distilled water twice for 10 mins. followed by centrifugation. As soon as the spores germinated, a suitable piece of medium (about 10 mm square) was cut out, transferred to a slide, and covered with a coverglass. A small droplet of lactophenol with cotton blue, added to the side of the square of medium, fixed and stained the basidia.

RESULTS

The studies of the sorus structure, spore development, morphology of the spore balls and spores, and germination of the spores of *Ustilago lyginiae* revealed character combinations which do not fit with any known genus (comp. Vánky, 1987). The molecular biological study of this fungus also shows an isolated position (Dr. D. Begerow, pers. comm.). To accommodate it a new genus is proposed :

Websdanea K. Vánky, **gen. nov.**

Sori in textura vegetativa plantarum Restionacearum, glomerulis sporarum pleni, maturi rumpentes. Sporarum glomeruli sporis tantum compositi procreatis a hyphis sporogenis dense aggregatis. Desunt peridium, columella et cellulae steriles. Sporae pigmentosae. Germinatio sporarum basidiis septatis vel basidiosporas super sterigmata vel hyphas efferentibus. Hyphae parasiticae inter et intra cellulas hospitis crescents. Typus generis: *Websdanea lyginiae*.

Sori in vegetative tissues of host plants belonging to Restionaceae. Sori filled with spore balls, bursting at maturity. Spore balls composed only of spores which are differentiated within a sporogenous mass of hyphae. Peridium, columella and sterile cells are lacking. Spores pigmented. Spore germination results in septate basidia on which basidiospores on sterigmata or also hyphae are produced. Parasitic hyphae inter- and intracellular. Typus generis:

Websdanea lyginiae (Websdane, Sivasithamparam, Dixon & Pate) K. Vánky, **comb. nov.**

Basionym: *Ustilago lyginiae* Websdane, Sivasithamparam, Dixon & Pate, Mycotaxon 48:485, 1993. — Type on *Lyginia barbata* (Labill.) R. Br., Australia, Western Australia, Perth, Gosnells suburb, 32°05'13" S, 115°58'40" E, 16.IV.1992, J. S. Pate. Holotype in PERTH, isotype in Herb. Kings Park, Perth.

Sori (Fig. 1) as bullate, dark reddish-brown striae on the distal internodes of the culms, ca. 1 x 1–50 mm, covered by the epidermis which ruptures at maturity

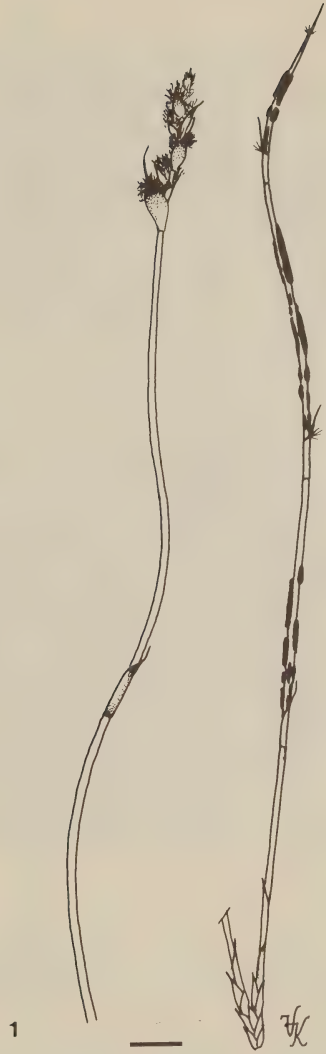
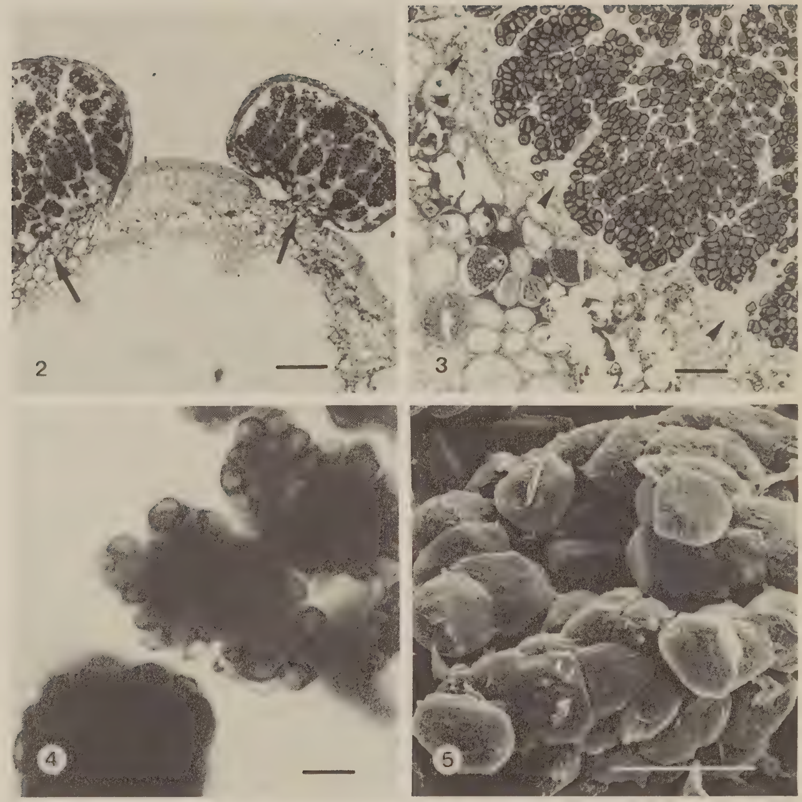


Fig. 1. Sori of *Websdanea lyginiae* (Websdane, Sivasithamparam, Dixon & Pate) K. Vánky, producing bullate striae on the stem of *Lyginia barbata* (Labill.) R. Br. Left a healthy, flowering plant (HUV 17819) Bar = 1 cm.



Figs. 2–5. *Websdanea lyginiae* (Websdane, Sivasithamparam, Dixon & Pate) K. Vánky on *Lyginia barbata* (Labill.) R. Br. (Vánky, Ust. exs. 996, HUV 17819).

Figs. 2, 3. TS of mature sori showing a part of the sectioned host stem, the isthmus (arrow) from which still fascicles of sporogenous hyphae (arrow heads) are penetrating into the sorus, separating large groups of spore balls into irregular, elongated portions. The sori are covered by a layer of pigmented host epidermis. Bars = 100 and 40 µm.

Figs. 4, 5. Spore balls and spores in LM and in SEM. In Fig. 4, the central spore ball may be composed of several, agglutinated balls. In Fig. 5, discrete, low warts of the outer spores can be seen. Bars = 10 µm.

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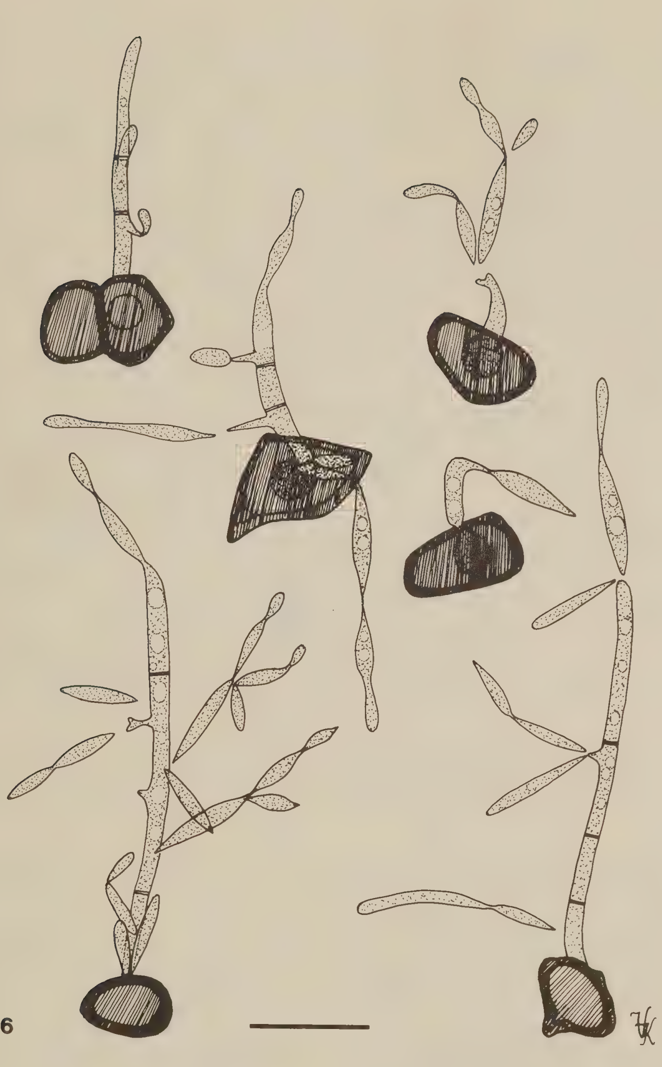

Fig. 6. Germinating spores of *Websdanea lyginiae* (Websdane, Sivasithamparam, Dixon & Pate) K. Vánky (on WA, at room temp., in 2 days; HUV 17819). On (1–)2–4-celled basidia, on sterigmata, fusiform or ovoid basidiospores are produced which bud giving rise to smaller, fusiform or ovoid cells or hyphae. Bar = 10 µm.

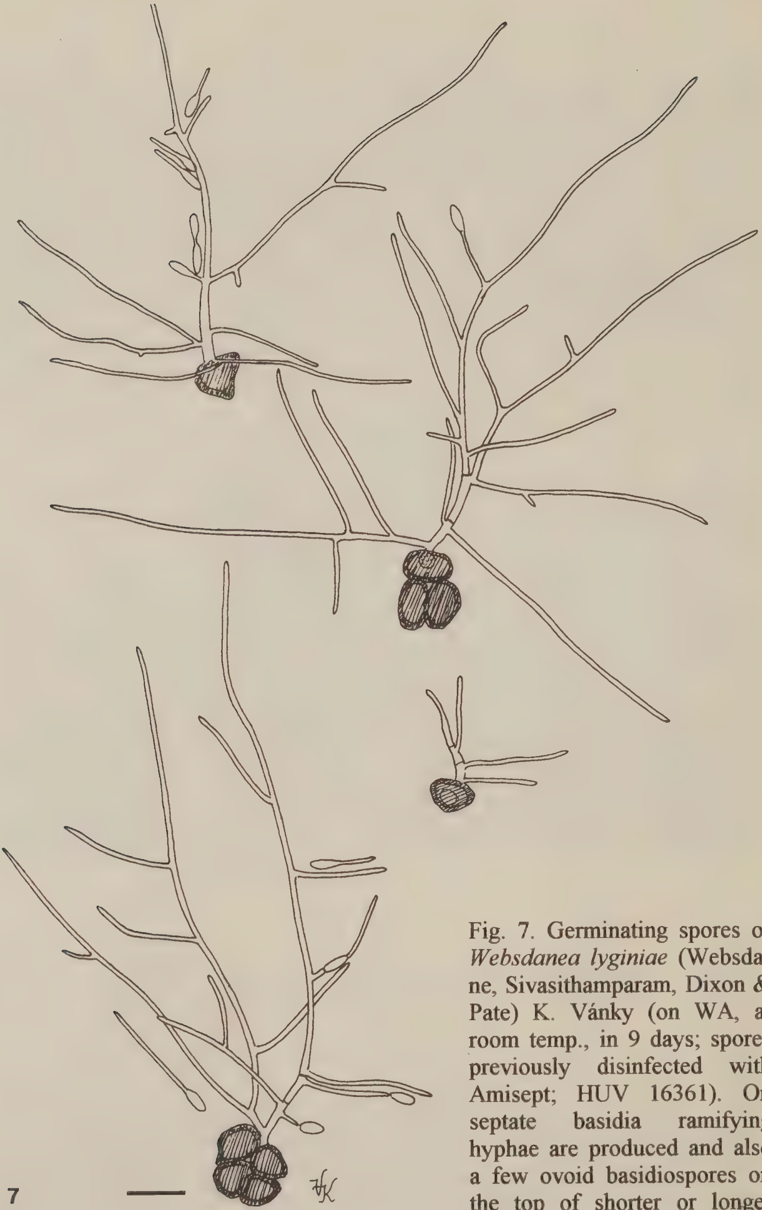

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Fig. 7. Germinating spores of *Websdanea lyginiae* (Websdane, Sivasithamparam, Dixon & Pate) K. Vánky (on WA, at room temp., in 9 days; spores previously disinfected with Amisept; HUV 16361). On septate basidia ramifying hyphae are produced and also a few ovoid basidiospores on the top of shorter or longer branches. Bar = 10 µm.

disclosing the black, granular-powdery mass of irregular, loose spore balls. The swollen sori develop in longitudinal depressions of the culm, starting from a more or less narrow isthmus composed of sporogenous hyphae and host cells permeated by inter- and intracellular hyphae. In young sori, within the basal, sporogenous hyphae, groups of spore balls are differentiating and during maturation pushed toward the periphery (comp. Websdane et al., 1993, figs. 5–8). When young, the groups of spore balls are separated into irregular lobes by fascicles of sporogenous hyphae which penetrate into the sori. During maturation, these fascicles disappear towards the periphery (Figs. 2, 3). Infection systemic; usually all culms of a plant are affected. Smutted culms are sterile. Spore balls (Figs. 2–5) variable in shape and size, subglobose, ovoid to usually irregularly elongated, 30–90 x 45–200 µm, dark olivaceous-brown, opaque, composed of a great number of easily separating spores. (The upper values given above may be a result of the measurements of several, tightly agglutinated spore balls). Spores (Figs. 3–6) extremely variable in shape and size, subglobose, ovoid, irregularly subpolyhedral or polyhedral, elongated, often prolonged into one or two shorter or longer, subacute or acute tips, (5–)6–9 x (6–)7–13(–16) µm, olivaceous-brown; wall uneven, 0.5–1.5 µm thick, in LM smooth, in SEM outer spores inconspicuously low verruculose, inner spores smooth. Spore germination (Fig. 6; on WA, at room temp., in 2 days) results in (1–)2–4-celled basidia measuring ca. 1.5 x (6–)20–40 µm. On the basidia, on well-developed sterigmata, fusiform or ovoid basidiospores are produced successively, measuring 1–1.5 x 3.5–12 µm. The basidiospores bud giving rise to smaller, fusiform or ovoid cells or hyphae. In other cases (Fig. 7; on WA, at room temp., in 9 days), on the basidia abundantly ramifying hyphae are produced and only a few ovoid basidiospores are born on the top of shorter or longer branches.

The reason for the different types of germination obtained for *Websdanea lyginiae* is not known. It may depend on varying external factors but also on the different collections which were used for these germinations.

According to Websdane (1995:77) all five morphotypes (R1, R2, R3, R4 and S) of *Lyginia barbata* (Labill.) R. Br. are hosts to the culm smut. Furthermore, she observed that spore morphology may vary between collections on different morphotypes. In some collections the spores are smaller, more round, in others they are larger, more irregular, elongate. Differences in spore germination may also be genetically fixed. Further studies are needed to elucidate if these differences are constantly connected to a certain morphotype and which taxonomical significance they have (different species?). It is interesting to mention that some Australian botanists consider these morphotypes, or at least some of them, to be separate taxa (partly unpublished data). Maybe these groups of both the host plants and their parasites are in an early stage of speciation?

Websdanea has in common with *Clintamra, Tolyposporium, Tolyposporella, Ustacystis* and some species of *Orphanomyces* the presence of black spore masses of spore balls composed of pigmented spores only, as well as the lack of sterile cells. The sorus localisation and structure, spore ball and spore morphology, spore germination and host family differentiate these genera from *Websdanea* (comp. Vánky, 1987) as do ultrastructural and molecular biological characters (comp. Bauer et al., 1997, Begerow et al., in press).

Etymology: *Websdanea* is named after the young Australian botanist, Dr. Kerstin Websdane who, in her excellent PhD thesis, studied the smut fungi of the Restionaceae (and Cyperaceae) of Western Australia, calling the attention to their ecology, their variability and also to several undescribed taxa. I.a., Dr. Websdane also described the type species of this genus. Unfortunately, due to lack of financial support, she is unable to continue her mycological career.

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I am grateful to Prof. K. Sivasithamparam (Perth, Australia) for reading the manuscript and serving as pre-submission reviewer, to Dr. M. Weiss (Tübingen, Germany) for providing the Latin description, to Dr. D. Begerow (Tübingen, Germany) for information about still unpublished molecular biological results, and to Dr. Kirsten Websdane (Perth, Australia) for her help during my collecting trips in Western Australia. I acknowledge the assistance of Mr. H. Schoppmann and Mr. F. Albrecht (Tübingen, Germany) with SEM and photographic work, respectively.

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MYCOTAXON

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A NEW BLUING *PSILOCYBE* FROM U.S.A.

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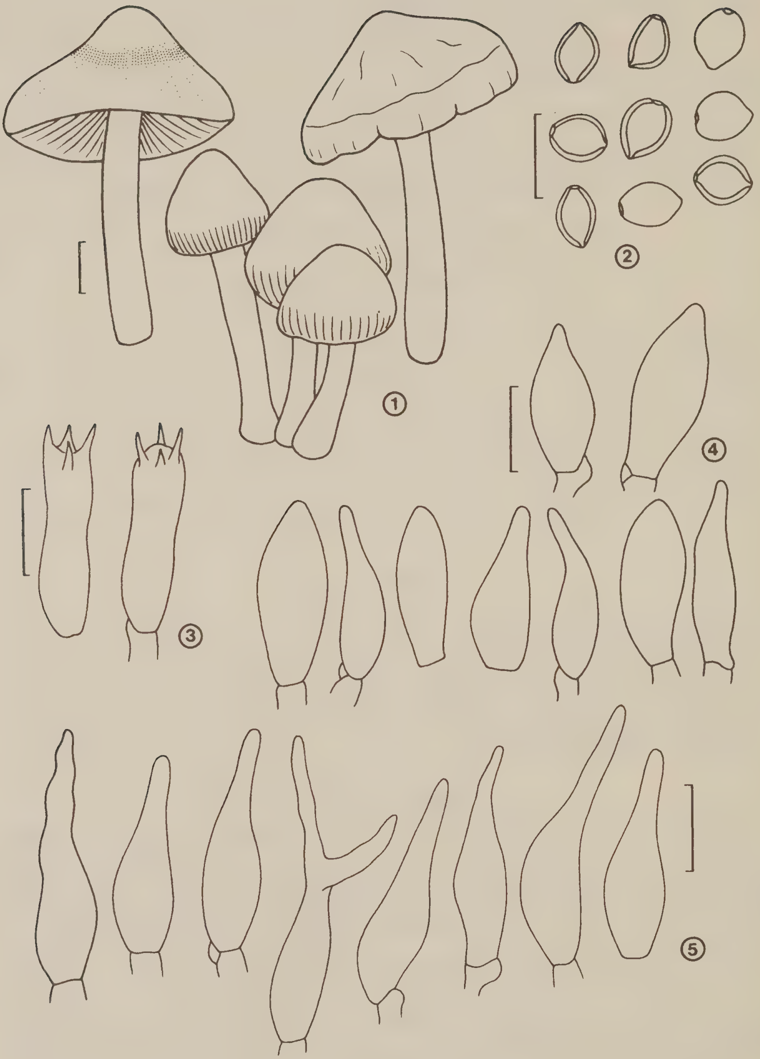
ABSTRACT

Psilocybe weilii from Georgia, U.S.A. (Section *Cordisporae*) is described as a new species. It grows on red clay soil under *Liquidambar* and *Pinus* trees. It is related to *P. heliconiae*, which is known only from a tropical rain forest at Colombia, but differs in the pleurocystidia and cheilocystidia, and in the smaller size of the basidiomata and in the weaker bluing reaction in that species.

INTRODUCTION

Species of the genus *Psilocybe* (Fr.) P. Kumm. are well represented in the U.S.A., where Guzmán (1983) reported 51 species, 15 of which are exclusive from that country. In a supplement to the monograph of the genus, Guzmán (1995) listed many new reports of *Psilocybe* species from various regions the world, but none from the U.S.A. More recently, Guzmán (1996) recorded *P. pseudobullacea* (Petch) Pegler for first time from the U.S.A., and *P. tampanensis* Guzmán & Pollock, previously known only from Florida, was reported for first time from Mississippi. The hallucinogenic fungus *P. caerulescens* Murrill, described from Alabama in 1923, has not been re-collected in the United States since, although it is very common in Mexico and extends to Panama and Venezuela (Guzmán, 1983).



Figs. 1-5. *Psilocybe weilii*, 1: basidiomata; 2: spores; 3: basidia; 4: pleurocystidia; 5: cheilocystidia. All from the holotype (scale bar 10 mm in 1, 10 μm in the others).

A collection of *Psilocybe*, initially thought to be *P. caerulescens* was gathered by one of the authors (Stamets) in Georgia. Upon further study, it was determined as a new species and is described here. Microscopic characters were observed from rehydrated sections mounted in 5% aqueous KOH. Colors of the basidiomata are based on Kornerup & Wanscher (1989).

PSILOCYBE WEILII

Psilocybe weilii Guzmán, Stamets & Tapia, sp. nov. Figs. 1-5

Pileus (20-)30-60 mm latus, convexus vel subcampanulatus, subumbonatus, laeves vel subfibrillosus, hygrophanus, luteos-brunneus vel brunneolus vel nigricans, summe subcaeruleus. Lamellae sinuatae, brunneolo-violaceae, ad margines albidae. Stipes 40-70 x 5-10 mm, albidus vel luteolus, summe subcaeruleus vel nigricans. Sporae (5.5-)6-7 (-7.5) x 5-6(-6.5) x (4-)4.5-5 µm, brunneolus, frontaliter subrhomboidae, lateraliter subellipsoidae. Pleurocystidia (10.5-)16-21.5(-24) x (4-)5-9.5(-10.5) µm, hyalina, copiosa, subfusoida vel ventricosa rostrata vel sublageniforma. Cheilocystidia (17.5-) 20-37.5(-41.5) x (4-)5-6.5(-7) µm, hyalina, copiosa, lageniforma collo simplici vel moniliformis vel subramoso. Epicutis pilearum subgelatinosa. Hyphae fibulatae. Ad terram argillae, in pinus sylva. U.S.A., prope Georgia, Stamets s.n., holotypus XAL.

Pileus (20-)30-60(-85) mm in diameter, obtusely conic to convex to campanulate, and subumbonate, often with irregular lobulated margin, subviscid when moist from a separable gelatinous pellicle, glabrous, smooth to subfibrillose or irregularly rimose, translucent-striate at the margin, hygrophanous, purplish brown (7E8) or brownish dark (7E7) to brownish dark (5F8), drying to straw yellow (5C7-3B6), with blackish brown (5F6) umbo, strongly brusing bluish, remaining completely blue black (close to 18F7) in some specimens, frequently with white scale-like remnants from the veil along the margin, which is inrolled or incurved at first to irregular expanding, and straighteng in maturity. **Lamellae** subadnate to sinuate, light brown or brownish yellow (4B6) to brownish violaceous (8F7-8F4), with whitish and subflocose edges. **Stipe** (25-)40-70 x (4-)5-10 mm, cylindric, slightly subbulbose, whitish to yellowish (1A2), bluish black (18DA-19F7), grayish straw (6D3), with vinaceous tones (8F7) when dry, hollow, frequently with a white, floccose mass of mycelium covering the base, surface with subfloccose whitish patches in the lower region, and pruinose to smooth above. Veil well formed as a white arachnoid coating in young stages, leaving sometimes a fibrillose subannular zone at the upper part of the stipe. Context whitish, fleshy at the pileus, cartilaginous at the stipe, with farinaceous taste and flavor. All parts except lamellae strongly staining blue green to blackish when mature or injured; the stipe frequently remains completely blue or with some irregular vinaceous tones (7D7). **Spore print** dark violaceous brown or violet brownish black (11F5).

Spores (5.5-)6-7(-7.5) x 5-6(-6.5) x (4-)4.5-5 μm, subrhomboid or obscurely subellipsoid in face view, subellipsoid in side view, with a brownish yellow thick wall up to 1 μm, with a broad apical germ pore and acute, short hilar appendix at the base. **Basidia** (22.5-) 24-28 (-29.5) x (5-) 5.5-6.5 (-7) μm, 4-spored, hyaline, ventricose with a median constriction. **Pleurocystidia** (10.5-) 16-21.5(-24) x (4-)5-9.5(-10.5) μm, hyaline, abundant, subfusoid or ventricose rostrate with a short apex, or sublageniform. **Cheilocystidia** (17.5-)20-37.5 (41.5) x (4-)5-6.5(-7) μm, hyaline, abundant, lageniform with a long neck, this sometimes moniliform or branched. **Subhymenium** subcellular, with globose elements 2.5-5.5 μm diam, pale brownish, with incrusted hyphae. **Hymenophoral trama** regular, with cylindric to somewhat inflated hyphae, 2.5-18.4(-24) μm broad, hyaline to brownish pale. **Epicutis** as a gelatinized to subgelatinized layer, 16-36 μm thick, formed by hyaline parallel hyphae, 1.5-4(-5) μm broad. **Hypodermium** with brownish yellow hyphae, with incrusted walls, cylindric to somewhat inflated hyphae. **Context** with hyaline to brownish pale hyphae, 2.5-20(-24) μm broad, cylindric or subglobose. **Clamp connections** present.

Habitat and distribution. Gregarious to cespitose, under *Liquidambar stiraciflua* L. and *Pinus taeda* L., in red clay soil enriched with needles of pine, at the edge of a private garden. Known only from the type locality.

Material studied. U.S.A., Georgia, Cherokee Co., near Alpharetta, September 1995, **Stamets 951101** (Holotype XAL; Isotypes NY and WTU).

DISCUSSION

This is the first bluing *Psilocybe* known from Georgia. Based on the bluing reaction and the form of the spores this species belongs to Sect. *Cordisporae* Guzmán. It is close to *P. heliconiae* Guzmán, Saldarriaga, Pineda, García & Velázquez, which is known only from an evergreen tropical rain forest in Colombia (Guzmán *et al.*, 1994), from which it differs in the size and form of the pleurocystidia [14-17 x 5-7(-9) μm, subglobose or ventricose, without an apex and not sublageniform], and in the size of the cheilocystidia [(18-)19-22(-24) μm long] in that species, as well as in the strongly pronounced bluing reaction in *P. weilii*, and in the smaller fruit body (pileus up to 30 mm diam) in that species. This new species is delimited from *P. caerulescens* by the presence of pleurocystidia. All the species of the Sect. *Cordisporae*, which present a bluing reaction and farinaceous taste and flavor and are hallucinogenic according to Guzmán (1983, 1995).

The name of the species is in honor of Professor Andrew Weil, from the University of Arizona, College of Medicine, in recognition of his studies on hallucinogenic fungi.

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CORTICIOID APHYLLOPHORALES (BASIDIOMYCOTA) FROM THE PATAGONIAN ANDES FORESTS OF ARGENTINA.
1. LACHNOCLADIACEAE ON *NOTHOFAGUS PUMILIO*

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Abstract

Three corticioid species of Lachnocladiaceae (Aphyllophorales) are recorded or described on fallen trunks and branches of *Nothofagus pumilio* in the subantarctic forests of Patagonia, Argentina. *Asterostroma andinum* is recorded on this substrate for the first time, though it is already known from the area. *Vararia cunninghamii*, a species previously described from New Zealand and there growing on *Nothofagus fusca* and *N. solandri* var. *cliffortioides*, is described and compared with authentic material. It is the first corticioid species so far known to show a subantarctic distribution. *Vararia incrustata* is described as new, being characterized by the presence of scarce, poorly branched, geometric and encrusted dichophyses, plus abundant sulphopositive gloeocystidia and inamyloid, ellipsoid spores.

Key words: Aphyllophorales, Lachnocladiaceae, *Vararia*, *Nothofagus*, Corticiaceae

Introduction

Nothofagus pumilio (Poepp. & Endl.) Krass. is the main native forest resource in the Patagonian Andes of Argentina. It covers more than 1 million ha, forming a long strip in the timberline along the southern Andes, from parallel 34 °S to Tierra del Fuego. Studies on the Corticiaceae s.l. found on this substrate have been initiated in order to improve the knowledge of the mycoflora associated with this species and to complement phytopathological studies in progress in our laboratory (Cwielong & Rajchenberg, 1995). In this work we present information on the Lachnocladiaceae so far found on this substrate. Unless other indicated, all specimens are kept at the Herbarium of the Centro Forestal CIEFAP. Color notations are from Munsell (1990).

Results

Asterostroma andinum Pat.,
Bull. trimest. Soc. Mycol. Fr. 9: 133, 1893.

Description: Cunningham, 1963; Jülich & Stalpers, 1980.

Habitat: On very decayed branches and trunks, generally growing on the innerside of the bark.

Material studied: Argentina, Chubut, Futaleufú, Lake Baggilt, on fallen branch, leg. M. Rajchenberg 10549, 24.III.92. Tierra del Fuego, Ushuaia, Río Pipo, track to the cascade, leg. C. Gómez, 17.II.74 (BAFC). Tierra del Fuego, Estancia El Valdez, leg. A. Greslebin 36, 29.XI.95. Tierra del Fuego, road to Termas, leg. ipse 94, 30.XI.95. Tierra del Fuego, Estancia El Valdez, River Valdez, leg. A. Greslebin 270 & M. Rajchenberg, 4.III.96. Tierra del Fuego, Estancia El Valdez, leg. A. Greslebin 275, 4.III.96. Tierra del Fuego, leg. ipse 274, 275 and 276, 4.III.96.

Remarks: Recorded from the area on *Nothofagus* sp. by Hjortstam & Ryvarden (1985).

Vararia cunninghamii Boid. & Lanq.,
Bull. trimest. Soc. Mycol. Fr. 91: 461, 1975. Figs. 1-7

Fruitbody resupinate, crustose to subceraceous, thin, 40-80 µm thick. Hymenial surface smooth, tuberculate, when dry, with a ceraceous aspect, pale yellow (2.5Y 8/3-8/4) to almost yellow (2.5Y 8/6). Margin undifferentiated and thinning out.

Hyphal system consisting of generative hyphae and dichophyses. **Generative hyphae** simple-septate, 1.5-3.0 µm in diam., poorly branched, thin-walled, arranged parallel to the substrate, tortuous in the subiculum. **Dichophyses**[1] dextrinoid, capillary and geometric with a capillary top; when capillary 15-20(-25) µm of across, with a basal stem 1(-1.5) µm in diam., intermediate branches 1-3 x 0.75-1 µm and the upper ones 6-8(-10) x 0.5 µm; when geometric with a capillary top (25-)30-40(-50) µm

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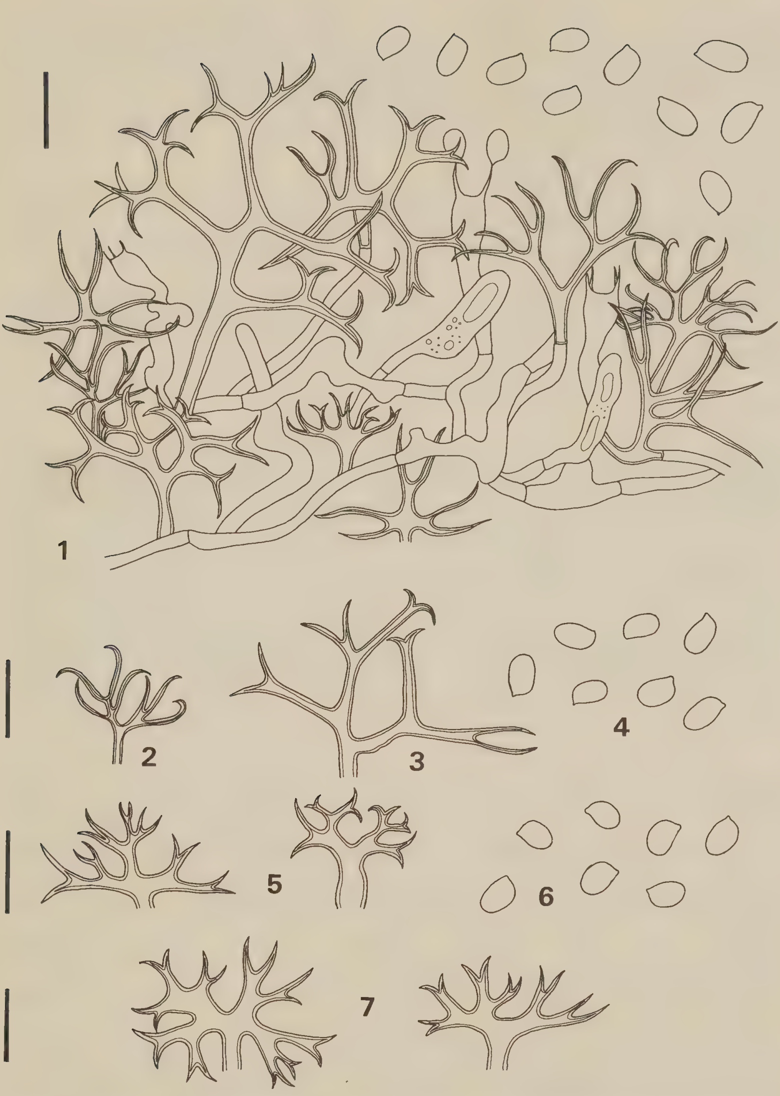
[1] Dichophyses described according to Boidin et al. (1980).



Figs. 1-7. *Vararia cunninghamii*. 1-4, Microscopic features of Argentinian specimen (Herb. CIEFAP 167). 1, Section through the hymenium. 2, Capillary dichophysis. 3, Geometric dichophysis with capillary top. 4, Basidiospores. 5-7, Microscopic features of New Zealand specimens. 5, Geometric dichophyses with capillary top (PDD 66384). 6, Basidiospores (PDD 66384). 7, Geometric dichophyses with capillary top (paratype, PDD 7069). Bars = 10 µm.

across, with a basal stem of 2 µm in diam., intermediate branches 5-8 x 1-2 µm and the upper ones 2-5 x 0.75 µm. Gloeopleurous hyphae, 3-5(-7) µm in diam., present as protuberant, refringent sections of hyphae.

Gloeocystidia fusoid to claviform, 20-30(-40) x (3-)4-7 µm, with oily and refringent contents, sulphonegative.

Basidia narrowly clavate, sometimes sinuous, with a basal swelling, tetrasporic, simple septate at base, 20-35 x 3-4 µm.

Basidiospores ellipsoid, 5-6 x 3-4 µm, thin-walled, smooth and amyloid.

Habitat (Argentinian material): On bark and sapwood of much decayed, fallen branches, associated with a white wood-rot.

Distribution: New Zealand and southern Argentina.

Material studied: Argentina, Tierra del Fuego, Fregosini forest exploitation stand, leg. A. Greslebin 167, 3.XII.95. Tierra del Fuego, Fregosini forest exploitation stand, leg. ipse 168, 3.XII.95. Tierra del Fuego, Estancia El Valdez, leg. A. Greslebin 336, 4.III.96. Tierra del Fuego, Estancia El Valdez, leg. ipse 141, 5.III.96. Tierra del Fuego, Ushuaia, on the road to El Martial glacier, leg. C. Gómez G-098, II.74 (BAFC). New Zealand, Wellington, Horopito, 1500 ft., on *Nothofagus solandri* var. *cliffortioides*, leg. J.M. Dingley, Mar.1948, det. J. Boidin & P. Lanquetin (PDD 7069, paratype). Mid Canterbury, Craigieburn Forest Park, on fallen log of *N. solandri* var. *cliffortioides*, leg. & det. P.K. Buchanan 8094, 14.XI.95 (PDD 66384). Mid Canterbury, Craigieburn Forest Park, on fallen log of *N. solandri* var. *cliffortioides*, leg. & det. ipse 8120, 15.XI.95 (PDD 66383).

Remarks: Specimens from Argentina are similar to those from New Zealand in most respects. New Zealand collections also have two types of dichophyses (a fact not indicated in the original description of the species), though even the largest are at most 30 µm across. The capillary dichophyses are similar in all specimens examined, but the geometric dichophyses with capillary tops of New Zealand specimens have a chunky, cauliflower appearance with basal stems up to 3 µm in diam., and shorter branches, i.e. (1-)2-3(-4) µm long, rarely 5 µm long (Figs. 5 and 7). The Argentininan specimens differ in that all the dichophyses (Figs. 1-3) readily react when mounted in IKI, whereas in the specimens from New Zealand only the superficial dichophyses become dextrinoid. A small difference in the size and shape of spores could also be detected between specimens from both areas: mostly 4-5 x 3-4 µm and ovoid, ellipsoid to broadly ellipsoid in the New Zealand specimens (Fig. 6), 5-6 x 3-4 µm and ellipsoid in the Argentinian specimens (Figs. 1 and 4). These differences are not considered to be significant as relatively few intact spores were observed. Most spores in the Argentinian specimens, the paratype and in PDD specimen 66383 were collapsed. PDD specimen 66384 is in very good condition and intact spores can be measured easily; a few of them also attain 6 µm in length.

Vararia incrustata Greslebin & Rajchenb. sp. nov. Figs. 8-13

Jacens, tenuis, crustosa, adhaerens, alba vel cremea, margine indeterminata. Hyphis genetricibus fibulatis. Gloeocystidiis 20-30 x 5-6 µm, fusiformibus vel claviformibus, tunica tenuis; dichophysibus paucibus, subhymenialibus, incrustatibus, dextrinoideis. Basidiis subutriformibus, 15-25 x 3-5 µm. Sporis ellipsoideis 4-5 x (2)-2.5-3 µm, inamyloideis. In ligno et corticibus Nothofagus pumilio, Argentina. Holotypus BAFC 34363.

Fruitbody resupinate, crustose, 90-200 µm thick, with indeterminate, arachnoid margins. Hymenial surface smooth, but adopting the irregularities of the substrate and sometimes presenting a granular and/or tubercular aspect, felty under the lens, white or cream colored.

Hyphal system consisting of generative hyphae and dichophyses. **Generative hyphae** clamped, thin-walled, 1.5-2(-3) µm in diam, abundant and dominant throughout the subiculum. **Dichophyses** scarce, subhymenial, geometric, poorly branched, with blunt apices, exceptionally with branches of 3rd order, (10-)15-30 µm across, with hyaline, thickened walls, dextrinoid, congophilous, acyanophilous, encrusted with irregularly shaped, small, sharp and blunt crystals that dissolve overnight in pure ammonia.

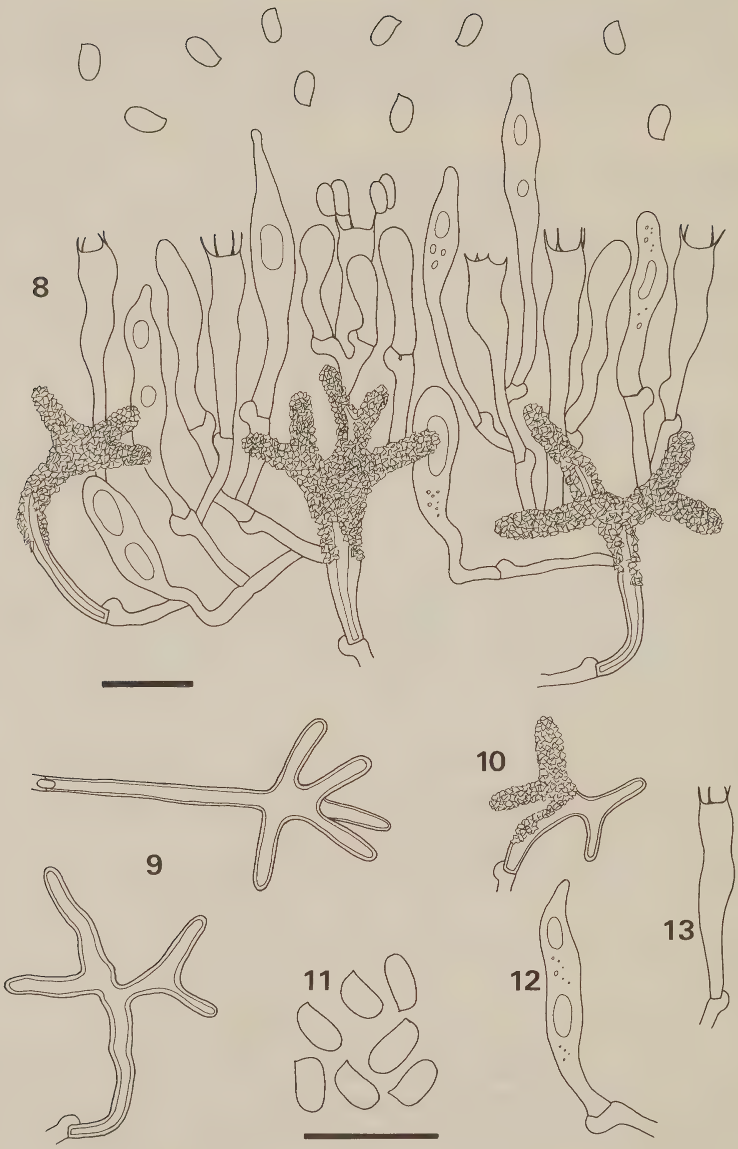
Gloeocystidia abundant, fusiform to clavate, 20-30 x 5-6 µm, hymenial to subhymenial, some emerging up to 15 µm beyond the hymenium, thin-walled, with granular contents, strongly sulphopositive.

Basidia subutriform, clamped, 15-25 x 3-5 µm, with four sterigmata.

Basidiospores ellipsoid, 4-5 x (2-)2.5-3 µm, thin-walled, smooth, inamyloid.

Habitat: On bark of fallen trunks and branches, associated with a white wood-rot.

Material studied: Argentina, Tierra del Fuego, road to Termas, leg. A. Greslebin 89, 30.XI.95 (BAFC 34363, Holotype). Tierra del Fuego, Lake Escondido, leg. ipse 113, 1.XII.95. Tierra del Fuego, Fregosini forest exploitation stand, leg. ipse 146, 3.XII.95 (BAFC 34364). Tierra del Fuego, Ushuaia, El Martial, leg. M. Rajchenberg 4063, 25.II.88, (BAFC 33754).



Figs. 8-13. *Vararia incrustata*, microscopic features (Holotype, BAFC 34363). 8, Section through the hymenium. 9, Two dichophyses without crystals. 10, A dichophysis with partial encrustation. 11, Basidiospores. 12, Gloeocystidia. 13, Basidia. Bars= 10 µm.

Remarks: The species is unique in the genus in the presence of encrusted, poorly branched and subhymenial dichophyses. Gloeocystidia give a strong sulphopositive reaction, but they disappear quickly in sulphobenzaldehyde mountant.

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CORTICIOID APHYLLOPHORALES (BASIDIOMYCOTA) FROM THE PATAGONIAN ANDES FORESTS OF ARGENTINA.
2. *HYPHODONTIA DECORTICANS* SP. NOV.

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Abstract

Hyphodontia decorticans sp. nov. is described in group *subalutacea*. It is characterized by long, cylindrical-suballantoid spores, 7-10 x 2.5-3 µm and large cystidia, 100-250 x 8-10-15 µm. The species fruits under the bark of twigs and small branches of *Nothofagus pumilio* causing bark peeling.

Key words: Corticiaceae, Aphyllophorales, Fungi, *Hyphodontia*, *Nothofagus*, new species.

During a survey of wood-inhabiting corticioid fungi found on *Nothofagus pumilio* in Argentina a new species in *Hyphodontia* has been found, which is herein described and illustrated.

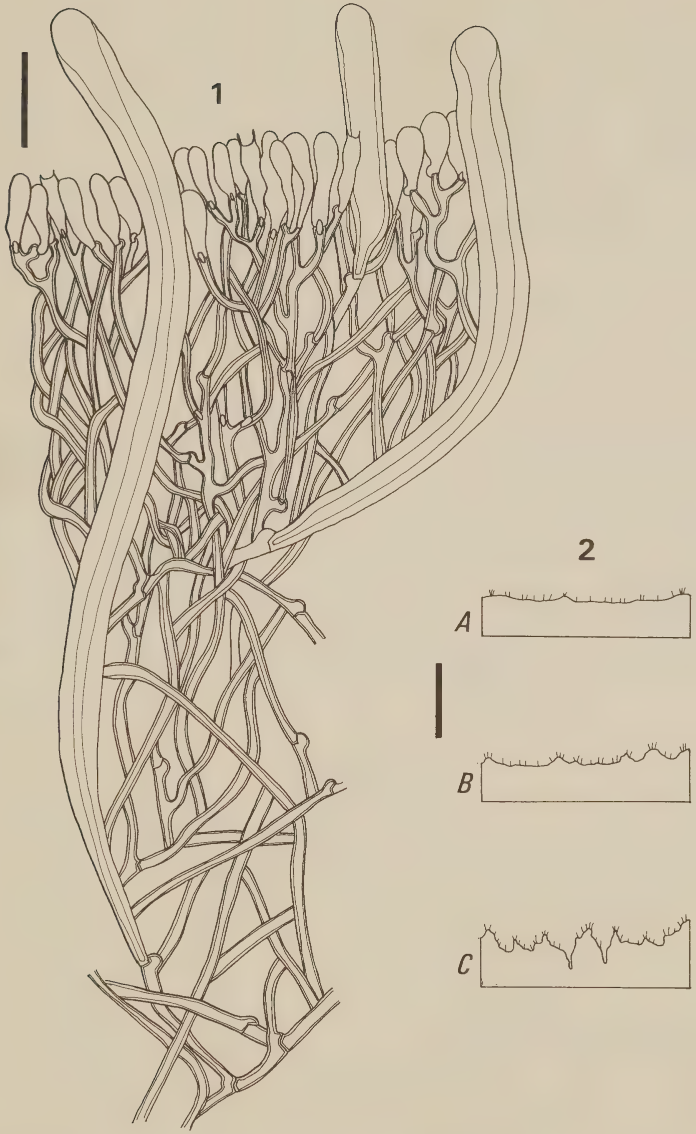
Hypodontia decorticans Greslebin & Rajchenb. sp. nov. Figs. 1-6
Fructificatio resupinata, levis vel irregulariter odontioidea, cremea vel pallide lutea, (65-)100-200(-250) µm crassa. Hyphae generatoriae fibulatae, crassitunicatae. Cystidia numerosa cylindrica, robusta, crassitunicata, apicem versus tenuitunicata, (60-)100-250(-280) x 8-10(-15) µm. Basidia subclavata, basaliter crassitunicata, 4-sterigmatibus. Basidiosporae cylindricae vel suballantoideae, 7-10 x 2.5-3 µm, leves, hyalinae, inamyloideae. Ad ramos decorticatos Nothofagus pumilio.
Holotypus BAFC 34380. Isotypus (GB). Paratypus BAFC 34381.

Fruitbody resupinate, tomentose, (65-)100-200(-250) µm thick, adnate, margin thinning out and arachnoid. Hymenial surface smooth, floccose to irregularly odontioid, velutinate under the lens, creamish white to light yellow, turning light ochre in spots.
Hyphal system monomitic. Generative hyphae with clamp connections, much branched, with hyaline and thickened walls, 3-5 µm in diam.
Cystidia numerous, cylindrical, robust and very long, (60-)100-250(-280)- x 8-12-(15) µm, sometimes sinuous, with walls thickened up to 6 µm except in the apical part, smooth or with resinous encrustation along the axis that may dissolve in KOH 5 %, sometimes presenting secondary simple septa; originating in the subiculum and projecting up to 70 µm beyond the hymenium.
Basidia subclavate, presenting or not a middle constriction, thin-walled or, more frequently with slightly thickened walls at the base, 15-25 x 5-6 µm, with four sterigmata and a basal clamp.
Basidiospores cylindrical to suballantoid, 7-10 x 2.5-3 µm, thin-walled, smooth, non-amyloid, sometimes with 1-2 oily guttulae.

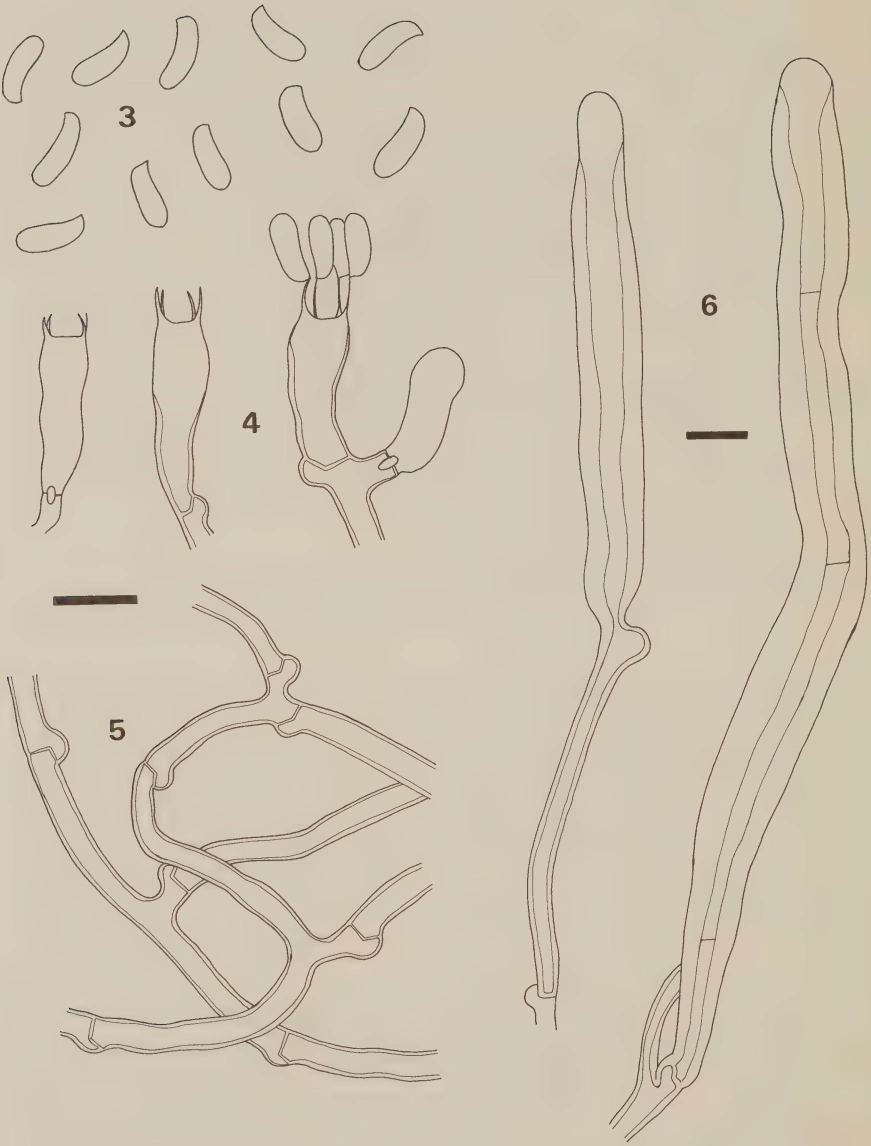
Habitat: on fallen twigs and branches of not more than 3 cm in diameter, causing decortication, the fruitbody forming beneath the bark, which breaks and detaches, exposing the hymenial surface.

Material studied: Argentina, Chubut, Futaleufú, Lake Baggilt, leg. M. Rajchenberg 10541, 24.III.92 (CIEFAP). Chubut, Río Senguer, Lake La Plata, leg. J. Bava (AG 753), 13.II.97 (CIEFAP). Tierra del Fuego, Ushuaia, on the road to Martial glacier, leg. C. Gómez, 24.II.74 (BAFC 33738). Tierra del Fuego, Garibaldi pass, leg. M. Rajchenberg, 29.II.88 (BAFC 33743, 33744, 33745), Tierra del Fuego, Estancia El Valdez, leg. A. Greslebin 182, 4.XII.95 (CIEFAP). Tierra del Fuego, Estancia El Valdez, leg. ipse 189, 5.XII.95 (BAFC 34380, Holotype). Tierra del Fuego, Estancia El Valdez, leg. ipse 204, 5.XII.95 (CIEFAP). Tierra del Fuego, Estancia El Valdez, leg. A. Greslebin & M. Rajchenberg 216, 4.III.96 (BAFC 34381, Paratype). Tierra del Fuego, Estancia El Valdez, leg. ipse 425, 5.III.96 (CIEFAP). Tierra del Fuego, National Park, leg. Nils Hallenberg 12482, 8.III.93 (GB).

Remarks: The new taxon pertains to the *subalutacea* group of species (Eriksson & Ryvarden, 1976), where it is distinguished by a thick context, relatively long and wide spores, prominent, robust cystidia, generative hyphae with thickened walls throughout the fruitbody and a particular habitat. In a phylogenetic analysis of morphological characters (Langer, 1994) it has been shown that all species of the *subalutacea*-group are characterized by only one cystidial type (tramacystidia). The sister group



Figs. 1-2, *Hyphodontia decorticans*. 1, Section through the fruitbody. Bar = 25 µm. 2, Schematical section of the fruitbody showing nearly smooth (A), floccose (B) and irregularly odontioid (C) hymenial surface. Bar = 0,3 mm.



Figs. 3-6, *Hyphodontia decorticans*. 3, Spores. 4, Basidia. 5, Generative hyphae. 6, Cystidia. Bars = 10 µm which comprises the rest of all *Hyphodontia* species is characterized by hymenial cystidia. Though in some specimens of *H. decorticans* short cystidia, 60-100 µm long, may be found in the hymenium, they are interpreted as being young ontogenetic stage. *Hyphodontia floccosa* (Bourdot & Galzin) J. Erikss. has similar but narrower cystidia, i.e. 6-7 µm wide, that are restricted to the aculeal parts, the hymenophore is distinctly odontioid and the spores are smaller, i.e. 5.5-7 x 1.5-1.8 µm. *Hyphodontia cineracea* (Bourdot & Galzin) J. Erikss. & Hjortstam differs in its smooth to finely flocculose hymenophore, smaller cystidia (80-120 x 6-7 µm) and shorter spores (5.5-6.5(-7) x 2-2.5(-3) µm). *Hyphodontia subalutacea* (P. Karst.) J. Erikss. has smaller, specially narrower spores (6-8 x 1.5-2 µm) and similar, but narrower cystidia (5-7 µm wide).

Acknowledgments

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EVIDENCE OF TRUFFLES IN SERBIA

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Abstract: This study is the first report on the presence of *Tuber macrosporum* Vitt. in Serbia (Yugoslavia). Also an early finding of *T. melanosporum* Vitt., *T. aestivum* Vitt. and *T. magnatum* Pico ex Vitt. in this region was confirmed. The identification was made according to size, structure and odour of fruiting bodies, size, shape and scanning microscopy of asci and ascospores. Also the type of soil, ectomycorrhizal associations and season of collecting the fruiting bodies were taken into account.

Key words: ascocarp, ascospore, *Tuber* spp.

Ectomycorrhizal fungi belonging to genus *Tuber (Ascomycotina, Pezizales, Tuberaceae)*, have been studied for centuries. The specific organoleptic properties of truffles were primarily in the domain of gastronomist's interest and aphrodisiac properties attributed to these fungi placed them in the category of the most expensive foodstuff in the world.

The results of extensive investigations of taxonomy, morphology, structure and ultrastructure, as well as of biochemistry and molecular biology of truffle's fruiting bodies or associations (mycorrhizas) they create with their host plants, were most frequently reported by French, Italian and Spanish researchers as recently reported by Giovannetti et al. (1994).

The presence of the species of genus *Tuber* was reported repeatedly in Europe, North America, Asia, North Africa and Australia. As far as the European continent is concerned, truffles are mainly linked to warmer regions of moderate climate, i.e. between 40° and 50° of north latitude. France, Italy, Spain and Portugal are territories especially abundant with these species. Also well known localities are situated in southern parts of Germany, as well as in Switzerland, Great Britain, The Netherlands, Austria, Poland, Czechoslovakia, Bulgaria, Hungary and Yugoslavia (Pacioni, 1987). According to data reported by Gorlenko (1976), truffles can be found as far to the east as Moldavia, Ukraine and Russia.

There is only a limited number of well documented data on natural habitats of truffles in Serbia published at the end of the last and the beginning of this century (Jurišić, 1897; Ranojević, 1905; Jekić, 1933; Lindtner, 1935; Frančišković, 1950). More recently new localities and new species (*T. aestivum*) have been reported in South-East Serbia (Milenković et al., 1992).

The aim of this study was determination of sites where *Tuber spp.* occur naturally in Serbia, i. e. the discovery of new and the confirmation of known localities, as well as the identification of the *Tuber* species collected during the investigation.

Materials and Methods

During the period December 1991-November 1993, by the aid of specially trained dogs, the inspection of terrain with characteristic woody species that was expected to provide adequate conditions for truffle mycorrhizae was carried out. Plastic bags were used for transportation of collected fruiting bodies. In the laboratory, the fruiting bodies were carefully washed, and after identification placed into containers filled with calcareous sand wetted with 70% ethyl alcohol. Identification of the species was made on the basis of macroscopic and microscopic characteristics of the fruiting bodies. Their structure and appearance were analyzed by a binocular microscope. The structure of ascus and ascospores was observed after staining in lactophenol or acid fuxin, and photos were taken by a "Karl Zeiss," Jenamed microscope, Jena. The parts of the gleba, without preceding preparation, were used for SEM analysis performed on a JEOL JSM T.35 scanning electron microscope. The pH of the soil samples was measured by a MA 5727 "Iskra" pH-meter.

Results

A satisfactory amount of fruiting bodies of *Tuber* species was discovered at eight localitites during the search for truffles in Serbia (Fig. 1). After comprehensive examinations and comparison with earlier determinations (Chatin, 1892; Delmas, 1989; Pacioni, 1987; Hrka, 1984, 1988), the following species were identified: *T. melanosporum, T. aestivum, T. macrosporum* and *T. magnatum.*

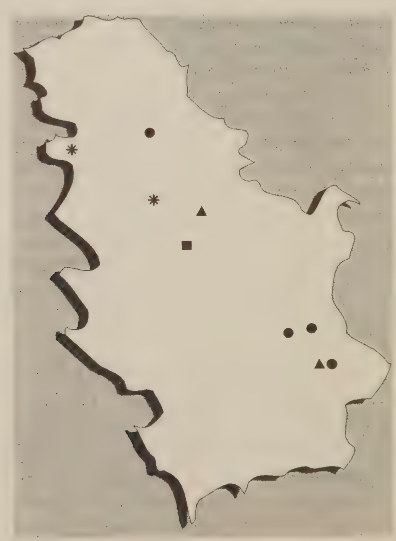


Fig. 1: Chart of Serbia with localities of four truffles species:

- ● *Tuber melanosporum;*
- ▲ *Tuber aestivum;*
- ✳ *Tuber macrosporum;*
- ■ *Tuber magnatum.*

Tuber melanosporum Vitt.

Fruiting bodies of pleasant odour were brought from terrain during winter months. These ascocarps were found within populations of various woody plants. In December 1991, they were discovered in an oak (*Quercus* spp.) forest in the close vicinity of hazel (*Corilus avellana* L.) trees. In January 1992 fruiting bodies were found in vineyards bordering with a forest of oaks (*Quercus* spp.), and in March 1992 in a forest composed of linden (*Tilia* spp.), European ash (*Fraxinus excelsior* L.), and walnut (*Juglans regia* L.) trees. All harvested truffles originated from alkaline soils pH 7.6-8.1 (Table 1).

The shapes of fruiting bodies varied between globular renniform or, more or less round (Fig. 2). Peridia were reddish-brown or nearly black brown in colour. The surface was covered with five- or six-angle warts, which were even more pronounced by longitudinal grooves. The warts had hollow tips and creased angles (Fig. 3). On the cross section of fruiting bodies, gleba was either grey-brown, reddish-brown or dark brown in colour with a web of wide veins (Fig. 4). The central vein was usually white, and lateral veins brown. Subtle veins were irregularly branched toward the edges. In fruiting bodies harvested in March a white central hole with softer spongy tissue was usually present.

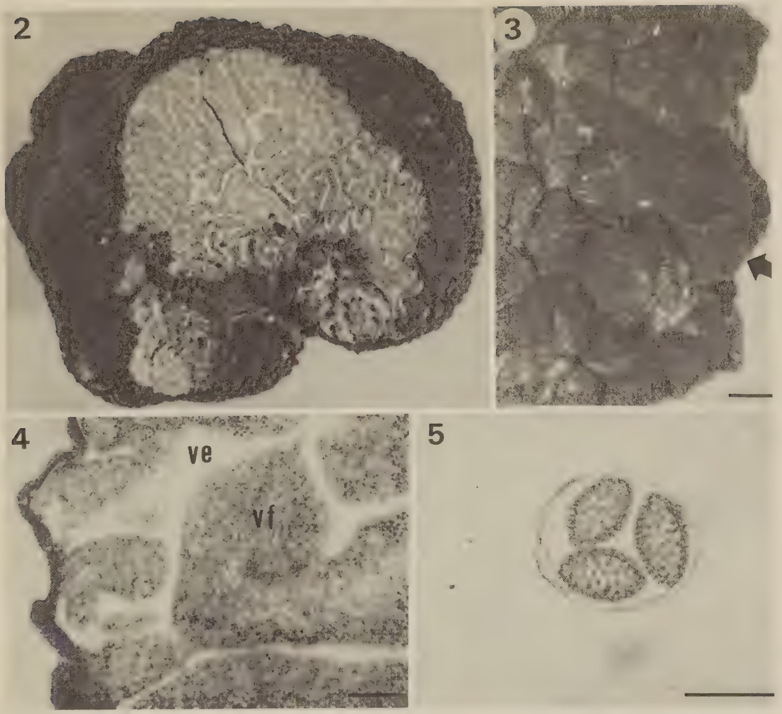
Round asci, contained 3-6 spores (Fig. 5). From the centre to the edges of the ascocarp, asci changed colour from orange, to dark brown and nearly black brown, due to the maturity of ascospores. The "darker" asci were more easily removed from surrounding tissue. The ascospores were oval or elongated in shape and black-brown in colour. Ascospores were covered with fine, thick and rigid spines (Fig.17 and 18). Spores were of various size (Table 2).

Table 1. Data on localities, time of collecting truffle and soil acidity.

Species	**Locality**	**Time of collecting**	**pH of soil**
T. melanosporum	Svrljig	december, 1991.	7.75
	Svrljig	january, 1992.	8.10
	Bela Palanka	january, 1992.	7.67
	Čortanovci	march, 1992.	-
T. aestivum	Bela Palanka	january, 1992.	8.50
	Požarevac	december, 1992.	7.74
T. macrosporum	Mala Moštanica	october, 1992.	-
	Morović	november, 1992.	7.33-8.70
T. magnatum	Batočina	october, 1992.	6.77-7.61
	Vojvodina	november, 1992.	-

Table 2. Ascospore size of different truffle species.

Species	Locality	Number of spores in ascus	Spore size (µm)					
			With spines (reticulum)			Without spines (reticulum)		
			Max	Min	Usually	Max	Min	Usually
T. melanosporum	Svrljig 91	4-6	38.3-22.5	20.7-22.5	33.8-22.5	27.0-12.0	18.0-18.0	20.5-15.7
	Svrljig 92	2-4	78.8-49.5	58.5-36.0	78.8-40.5	38.3-24.8	20.3-15.8	24.7-13.5
	B. Palanka	4-5	36.0-20.3	24.7-13.5	36.6-20.2	22.5-20.3	15.7-11.3	22.5-13.5
	Čortanovci	4-6	45.0-31.5	24.2-18.0	33.7-27.0	38.3-22.5	20.3-9.0	22.5-15.7
T. aestivum	B. Palanka	3-4	67.5-49.5	45.0-27.0	54.0-49.5	31.5-20.3	18.0-18.0	24.7-13.5
	Požarevac	2-4	67.5-49.5	49.5-36.0	54.0-40.5	51.8-40.5	36.0-27.0	40.5-33.8
T. macrosporum	M. Moštanica	3	76.5-54.0	45.0-36.0	56.3-40.5	65.3-42.8	33.8-27.0	49.5-27.0
	Morović	1-3	76.5-40.5	54.0-36.0	72.0-49.5	67.5-31.5	45.0-27.0	58.5-45.0
T. magnatum	Batočina	1-2-3	38.3-31.5	27.0-24.8	31.5-14.2	27.0-22.5	20.3-15.8	27.0-20.2
	Vojvodina	2-3	51.8-33.8	31.5-29.3	36.0-27.0	33.8-27.0	22.5-18.0	24.8-18.0



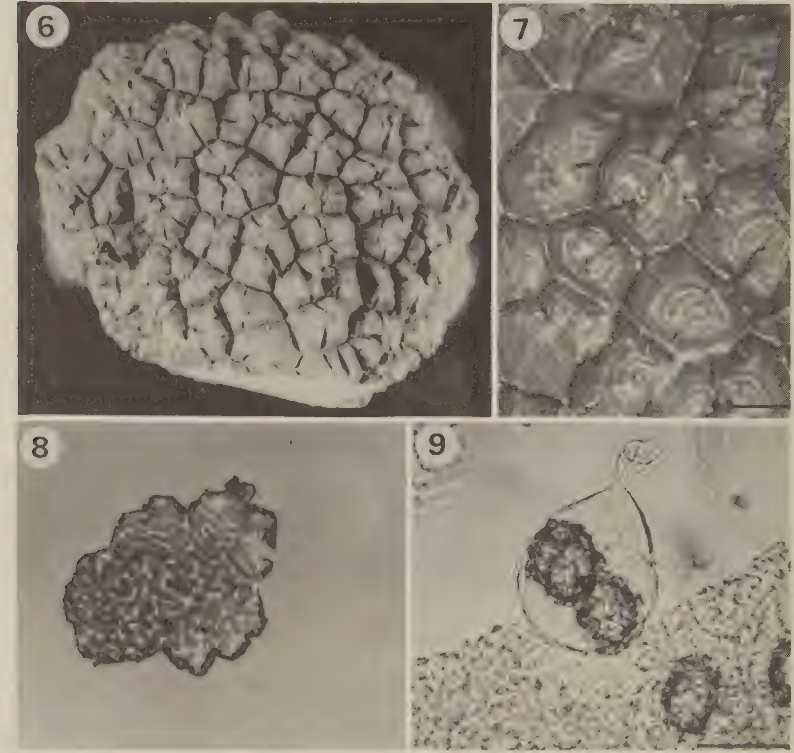
Figs. 2-5. *Tuber melanosporum* 2. Cross-section of fruit body. 3. Peridium detail with hollowed warts (Bar=1000µm). 4. Gleba detail: *venae externae* (ve) and *venae fertilae* (vf) (Bar=1000µm). 5. Ascus with 3 ascospores (Bar=40µm).

Tuber aestivum Vitt.

In the forest composed of red oak (*Quercus robur* L.), black poplar (*Populus nigra* L.) and European hornbeam (*Ostrya caprinifolia* Scop.), with alkaline soil pH-7.7-8.5 (Table 1) the truffles of rather firm consistency were found.

Truffles of not so intensive odour, had an irregular round shape and 2-3 cm in diameter (Fig. 6). Their peridium was dark brown or black, with large prominent polygonal warts of different size. Rigid pyramidal warts were slightly hollowed with white transversal creases at the surface (Fig. 7). The gleba, pale yellow or hazelnut in colour, had a thick web of white, short, irregular, branched and vastly dispersed veins (Fig. 8).

Nearly spherically shaped asci had a funnel-like stalk swollen at the base (Fig. 9). Asci containing orange or pale brown ascospores were elliptical or round-shaped, with honeycomb shaped surfaces (fig 19). Alveoli were sparse and very short, and formed reticular ornamentation (Fig. 20). Ascospores, 1-4 per ascus, were tightly packed and their size varied considerably (Table 2).



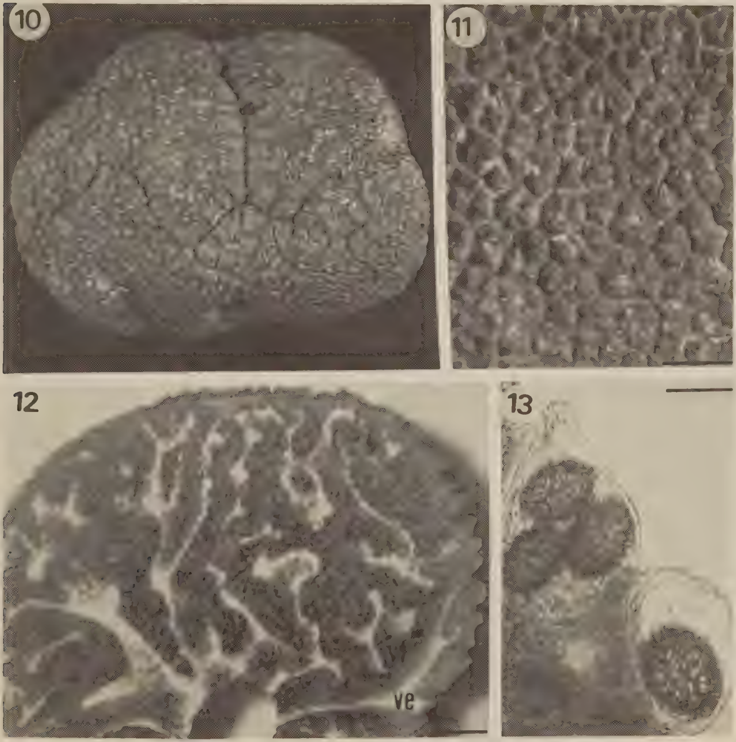
Figs. 6-9. *Tuber aestivum* 6. Fruiting bodies with very large warts. 7. Polygonal warts with white transversal grooves (Bar=1000µm). 8. Gleba detail with a dense web of subtle veins. 9. Spherical ascus with a stalk swollen at the base (Bar=40µm).

Tuber macrosporum Vitt.

A certain number of nut-size fruiting bodies was discovered in occasionally flooded forests of red oak (*Quercus robur* L.), maple (*Acer campestre* L.) and black poplar (*Populus nigra* L.). The truffles of slightly expressed odour similar to the garlic, which is typical for this species, were excavated from the white clay soil, pH 7.30-8.70 (Table 1).

Ascocarps were round with characteristic creases over the surface (Fig. 10). Peridium, covered with warts, had the colour that varied from brown reddish to that of rust (oxidized iron). The warts were irregularly polygonal, small, low and settled, and slightly folded (Fig. 11). Somewhat bigger warts were located next to the creases. Rather hard gleba, dark brown in colour, had large short white veins, ending on the edge of peridium in the form of the letter "Y" (Fig. 12).

In this species asci were very lightly and easily isolated from the gleba (Fig. 13). Bag-shaped asci with short stalks contained 1-3 very large ascospores (Fig. 21). Spores, of different size (Table 2), were ellipsoid in shape and had a reticular ornamentation (Fig. 22). The size of alveoli can vary significantly in the same species *T. macrosporum* (Figs. 21 and 22).

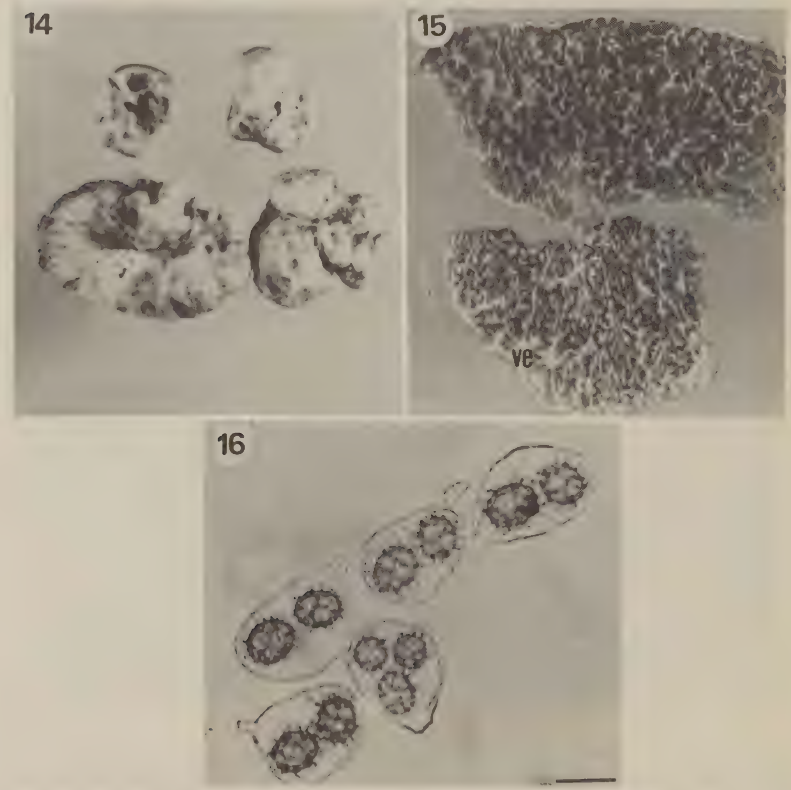


Figs. 10-13. *Tuber macrosporum* 10. Fruiting body with characteristic grooves and large warts in their vicinity. 11. Peridium detail; irregularly polygonal warts, low and settled (Bar=1000µm). 12. Gleba detail; *venae externae* (ve) branch toward the edges in the form of the letter Y and *venae fertilae* (vf) (Bar=1000µm). 13. Asci with 1-3 ascospores; ascus stalk short (Bar=40µm)

Tuber magnatum Pico ex Vitt.

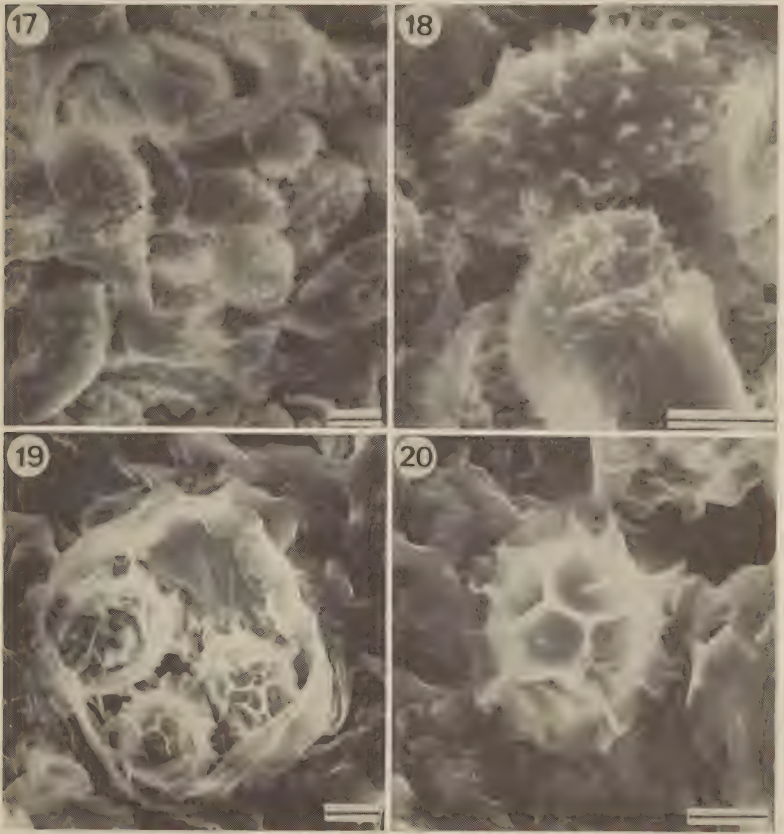
White truffles were harvested in the forest consisting of red oak (*Q. robur* L.) and black poplar (*P. nigra* L.) trees. These truffles emanated a very intensive aromatic odour similar to a mixture of garlic and French aromatic cheeses. The soil surrounding the fruiting bodies was almost neutral, pH being 6.7-7.6 (Table 1).

Ascocarp was in the shape of a slightly flattened irregular globe, separated sometimes in several distinct lobes (Fig. 14). The colour of smooth peridium varied from amber to pale brown or light yellow, sometimes with red-purple shades. The truffle had soft fleshy consistency. The gleba, white to pale brown in colour could be distinguished on cross section. It had subtle, tiny sinuous veins white in colour. There was a pronounced web of numerous, tiny anastomatically connected veins that terminated irregularly at the rim of tubercle (Fig 15).

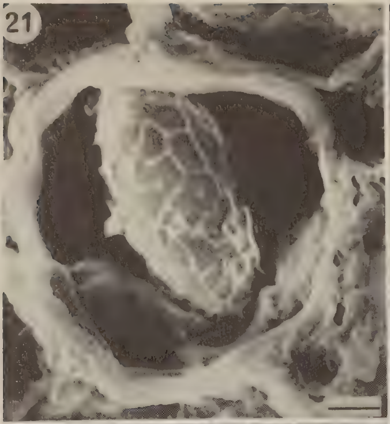


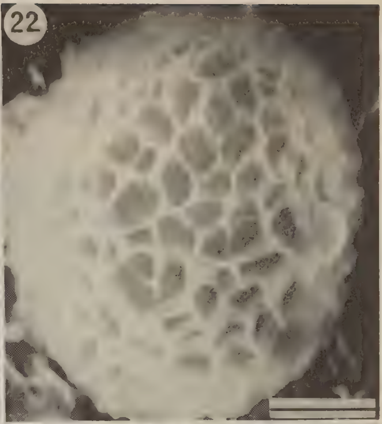
Figs. 14-16. *Tuber magnatum* 14. Fruiting bodies with or without lobi. 15. Gleba parts with fine subtle white *venae externae* (ve). 16. Five asci with short stalks, containing 2-3 ascospores (Bar=40μm).

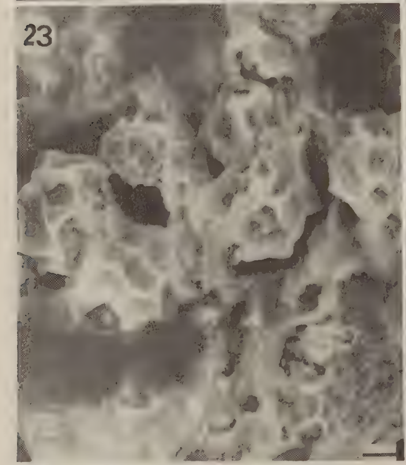
Round, bag-like asci had a short stalk and contained 1-3, rarely 4 spores (Fig. 16). If more than 1 spore was present they were smaller in size (Table 2). The surface of oval, and sometimes elliptical ascospores was ornamented in the form of honeycomb with large and uneven alveoli (Fig. 23 and 24).

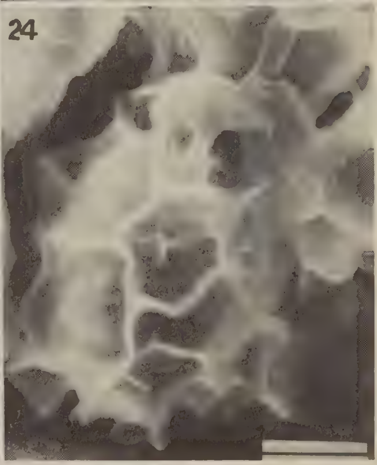


Figs. 17-24. SEM (Bar=10μm) 17. Ascospores in ascus *T. melanosporum*. 18. Ascospores *T. melanosporum* with spines ornamentation. 19. Ascus with 3 ascospores *T. aestivum*. 20. Ascospore with reticular ornamentation *T. aestivum*. 21. Ascospore in ascus *T. macrosporum*. 22. Reticularly ornamented ascospore. Alveoli regular and smaller *T. macrosporum*. 23. Ascospores *T. magnatum*. 24. Round-shaped reticularly ornamented ascospore with wide and irregular alveoli *T. magnatum*.









Discussion

Four species of ectomycorrhizal fungi were identified at already known but also at some new localities in Serbia. The presence of *T. melanosporum* and *T. magnatum* on this territory, at localities known from previous works (Jurišić, 1897; Ranojević, 1905; Jekić, 1933; Lindtner, 1935, Frančišković, 1950), was confirmed in the present study. However, four new sites were discovered. The new localities are situated in the South-East and North-West regions of Serbia. During our earlier work *T. aestivum* was found for the first time in Central-Serbia (Milenković et al., 1992). In this study *T. macrosporum* was for the first time detected in two separate localities of this region.

Our results regarding the size of *T. melanosporum, T. aestivum, T. macrosporum* and *T. magnatum* ascospores are in accordance with those reported for truffles from

France (Chatin, 1892; Delmas, 1989), Spain (Pacioni, 1987), Great Britain (Minter&Zang, 1989) and Croatia (Ugrenović, 1948; Paškvan, 1956; Božac, 1986; Focht, 1987; Hrka, 1984; 1988). Some of the differences, however, could be ascribed to the maturity of the truffles.

All harvested ascocarps were found within the populations of woody plants known for ectomycorrhizal associations of truffles. The seasons, that is months of the year, when truffles were found are in accordance with the data on the truffle harvest in other parts of Balkan Peninsula (Hrka, 1988) and Europe (Delmas, 1989). Analyzed fruiting body properties, plant community and soil characteristics, correlated well with the data cited by Chatin, 1892; Delmas, 1989; Pacioni, 1987; Hrka, 1984; 1988.

Compared to some other parts of the world, the interest in truffles occurred relatively late in our country.

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USTILAGINALES FROM THE SPANISH PYRENEES AND ANDORRA.

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ABSTRACT: An annotated check-list of the Ustilaginales known of the Spanish Pyrenees and Andorra is given. Eleven of the forty nine taxa recorded, are new records for Spain: *Anthracoidea caryophylleae* Kukkonen, *A. hostianae* B. Lindeb., *A. humilis* Vánky, *A. irregularis* (Liro) Boidol & Poelt, *A. paniceae* Kukkonen, *A. sempervirentis* Vánky, *Microbotryum dianthorum* (Liro) H. Scholz & I. Scholz, *Urocystis leimbachii* G. Örtel, *Urocystis primulicola* Magnus, *Ustilago marginalis* (DC.) Lév. and *U. trichophora* (Link) Körn. *Ustilago nebrodensis* Gonz. Frag. described on *Melica ciliata* for the Spanish Pyrenees was in fact growing on *Cynodon dactylon* (L.) Pers, and should be considered a synonym of *Ustilago cynodontis* (Henn.) Henn.

Keywords: Ustilaginales, Iberian Peninsula, Pyrenees, distribution.

RÉSUMÉ: Une liste commentée d'Ustilaginales des Pyrénées espagnoles et Andorre est donnée. Des 49 taxons de la liste, 11 sont cités pour la première fois dans la flore espagnole: *Anthracoidea caryophylleae* Kukkonen, *A. hostianae* B. Lindeb., *A. humilis* Vánky, *A. irregularis* (Liro) Boidol & Poelt, *A. paniceae* Kukkonen, *A. sempervirentis* Vánky, *Microbotryum dianthorum* (Liro) H. Scholz & I. Scholz, *Urocystis leimbachii* G. Örtel, *Urocystis primulicola* Magnus, *Ustilago marginalis* (DC.) Lév. et *U. trichophora* (Link) Körn.

Ustilago nebrodensis Gonz. Frag. décrit comme parasite de *Melica ciliata* dans les Pyrénées espagnoles doit être consideré un synonyme de *Ustilago cynodontis* (Henn.) Henn., sur *Cynodon dactylon* (L.) Pers.

Mots clé: Ustilaginales, Péninsule Ibérique, Pyrénées, chorologie.

RESUMEN: Aportamos una lista comentada de los táxones citados o estudiados de los Ustilaginales de los Pirineos españoles y Andorra. Se incluyen 49 táxones, de los cuales los 11 siguientes son nuevas citas para España: *Anthracoidea caryophylleae* Kukkonen, *A. hostianae* B. Lindeb., *A. humilis* Vánky, *A. irregularis* (Liro) Boidol & Poelt, *A. paniceae* Kukkonen, *A. sempervirentis* Vánky, *Microbotryum dianthorum* (Liro) H. Scholz & I. Scholz, *Urocystis leimbachii* G. Örtel, *Urocystis primulicola* Magnus, *Ustilago marginalis* (DC.) Lév. y *U. trichophora* (Link) Körn.

Ustilago nebrodensis Gonz. Frag. descrito como parásito de *Melica ciliata* para los Pirineos españoles, se encuentra en realidad parasitando a *Cynodon dactylon* (L.) Pers., y debe ser considerado como sinónimo de *Ustilago cynodontis* (Henn.) Henn.

Palabras clave: Ustilaginales, Península Ibérica, Pirineos, corología.

INTRODUCTION

The results of the studies of Ustilaginales from the Spanish Pyrenees and Andorra are presented. These studies are part of the *Flora Mycologica Iberica* project, which purposes are the confection, edition and publication of a critical flora which enables the identification of fungi naturally growing in the Iberian Peninsula and Balearic Islands (Tellería & Melo, 1995). The Pyrenees is a mountain range of about 400 km, located on the isthmus that connects the Iberian Peninsula and France, between the Mediterranean sea and the Atlantic ocean (Figure 1).

González Fragoso was the first who studied the Spanish Ustilaginales at the beginning of the century. His work was continued by authors like B. Fernández Riofrío, L. M. Unamuno or M. J. Urríes. Their studies are mostly works on distribution of Iberian microfungi. Several of those papers report Ustilaginales of the Pyrenees: González Fragoso (1915, 1917, 1919, 1922, 1927), Fernández Riofrío (1922, 1929), Unamuno (1941). Urríes (1932, 1942, 1944, 1959).

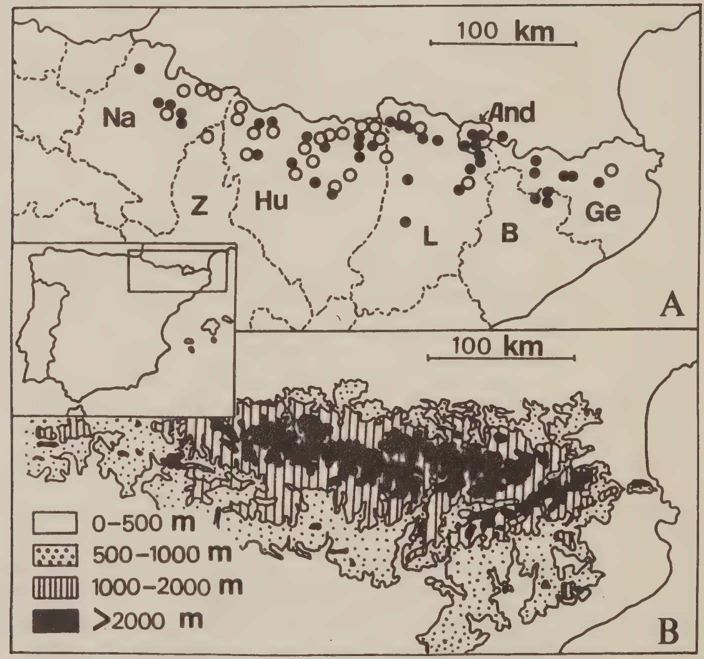

Figure 1: The Pyrenees. A: Situation of the Spanish provinces and Andorra in the Pyrenees: Andorra (AND), Barcelona (B), Gerona (Ge), Huesca (Hu), Lérida (L), Navarra (Na), Zaragoza (Z).●: Literature records.○: Field records. B: Altitude zones.

The most extensive contributions to the knowledge of the Iberian Ustilaginales are due to Durrieu during the 1960s. He studied the ecology and distribution of some groups of parasite fungi on vascular plants from the Pyrenees and surrounding areas. All his records are included in his final catalogue (Durrieu, 1966).

METHODOLOGY

The studied material comes from field collections, specimen found on herbarium sheets from MA vascular plant collection, and fungus specimens kept in MA-Fungi and MA-Funhist (Real Jardín Botánico, Madrid). Specimens collected by us are kept in MA-Fungi herbarium and in Durrieu's herbarium (Laboratoire Botanique et Forestier, UPS, Toulouse).

For the taxonomic treatment we follow Vánky (1994). Author abreviations follow Brummitt & Powell (1992). For the names of the host plants we follow Tutin & al. (1964-1980), and Castroviejo & al. (1990).

Microscope slides mounted in PVA (Omar & al., 1979), were made for all specimens.

LIST OF TAXA

The list includes all species known from the Spanish Pyrenees and Andorra. For the literature records, province, author and year of publication, the name with which it was published (if different from the accepted name) and host plant are given. Some of the bibliografic records have been checked; in these cases the herbarium number is indicated within brackets.

For field collections, locality, UTM grid co-ordinates, altitude, host plant, collecting date, collector number (TAL) and MA-Fungi number are given. For the specimens found in MA vascular hebarium, MA number is indicated within brackets.

An asterisk before the taxon names indicates a first record for Spain, before the province, indicates a first provincial record and before the host plant indicates a taxon recorded for the first time as a host for that smut fungi.

Anthracoidea caricis (Pers.) Bref.

Bibliographic records:

HUESCA (Hu): Durrieu (1966), as *Cintractia caricis* (Pers.) Magnus, on *Carex* sp.

Specimens examined:

*LÉRIDA (L): Coll de Nargó, between Coll de Nargó and Coll de Boixols, 31TCG56, 900 m, on nutlets of *Carex halleriana* Asso, MA-Fungi 32890.

***Anthracoidea caryophylleae** Kukkonen

Specimens examined:

LÉRIDA (L): Alto Arán, Malo stream, near Estanys del Rosari de Baciber, 31TCH32, on nutlets of *Carex caryophyllea* Latourr., 2-VIII-1994, TAL149, MA-Fungi 32971.

Anthracoidea elynae (Syd.) Kukkonen

Bibliographic records:

HUESCA (Hu): Durrieu (1966), as *Cintractia elynae* Syd., on *Kobresia bellardii* (All.) Degl. ex Loisel. [*Kobresia myosuroides* (Vill.) Fiori], [reported by Kukkonen (1963)].

Specimens examined:

HUESCA (Hu): San Juan de Plan, southern slope of Posets, from Refugio de Viadós, 31TBH8827, 2350 m, on nutlets of *Kobresia myosuroides* (Vill.) Fiori, in pasture, 16-VIII-1995, TAL287, MA-Fungi 34539.

Comments: Kukkonen (1963: 66) recorded this species from Castanesa, on *Kobresia myosuroides*, but misplaced this locality in France. Castanesa is a Spanish village belonging to Huesca province. This species is also known from the French Pyrenees (MA-Funig 32892). Our collection is the second record for Spain and for this province. *Anthracoidea elynae* differs from others pyrenean *Anthracoidea* species in having smooth disc-shaped spores, subcircular in top view. (Figure 2.a).

***Anthracoidea hostianae** B. Lindeb.
Bibliographic records:
LÉRIDA (L): Llorens (1985), as *Cintractia limosa* Syd. On *Carex lepidocarpa* Tausch.

Comments: Llorens considered the smut on *Carex lepidocarpa* as *Cintractia limosa*. *Carex lepidocarpa* belongs to the section *Ceratocystis*, so we consider its smut is probably *Anthracoidea hostiana*. *Anthracoidea limosa* (Syd.) Kukkonen (*Cintractia limosa* Syd.) is restricted to Carex species in the section *Limosae*.

***Anthracoidea humilis** Vánky
Bibliographic records:
HUESCA (Hu): Durrieu (1966), as *Cintractia caricis* (Pers.) Magnus. On *Carex humilis* Leyss., [MA-Fungi 32889]!.

***Anthracoidea irregularis** (Liro) Boidol & Poelt
Specimens examined:
HUESCA (Hu): Bielsa, northern slope of Portilla de Tella, 31TBH7022, 1600 m, on nutlets of *Carex ornithopoda* Willd., 15-VII-1994, TAL97, MA-Fungi 32962.

***Anthracoidea paniceae** Kukkonen
Specimens examined:
LÉRIDA (L): Salardú, on nutlets of *Carex panicea* L., VII-1927, MA-Funhist 16894! [in sched.: *Anthracoidea caricis*].

Anthracoidea pratensis (Syd.) Boidol & Poelt
Bibliographic records:
LÉRIDA (L): Llorens (1985), as *Cintractia pratensis* Syd. On *Carex flacca* Schreb.
NAVARRA (Na): Urríes (1942), as *Cintractia caricis* (Pers.) Magnus, on *Carex serrulata* Biv. ex Spreng. [*C. flacca* Schreb.].
Specimens examined:
*HUESCA (Hu): Bielsa, northern slope of Portilla de Tella, 31TBH7022, 1600 m, on nutlets of *Carex flacca* Schreb., 15-VII-1994, TAL99, MA-Fungi 32963. Bara, Sierra de Guara, 30TYM3690, 935 m, on nutlets of *Carex flacca* Schreb., on calcareous soil, 25-VI-1995, TAL308, MA-Fungi 34544.
*NAVARRA (Na): Puerto de Loiti, N-240 between Idocín y Aldunate, 30TXN32, 720 m, on nutlets of *Carex flacca* Schreb., VI-1965, MA-Fungi 32888. Abaurrea Baja, 30TXN4653, 800 m, on nutlets of *Carex flacca* Schreb., 11-VII-1994, GN3410, MA-Fungi 32958.
*ZARAGOZA (Z): Salvatierra de Escá, road near Sigüés, 30TXN6224, 550 m, on nutlets of *Carex flacca* Schreb., in *Quercus rotundifolia* woodland, 14-VII-1994, TAL91, MA-Fungi 32961.

***Anthracoidea sempervirentis** Vánky

Specimens examined:

HUESCA (Hu): Bielsa, portilla de Tella, 31TBH6922, 2050 m, on nutlets of *Carex sempervirens* subsp. *sempervirens* Vill., 15-VII-1994, TAL108, MA-Fungi 32965. Bielsa, portilla de Tella, 31TBH6922, 2070 m, on nutlets of *Carex sempervirens* subsp. *sempervirens* Vill., 15-VII-1994, TAL113, MA-Fungi 32968. Bielsa, Pineta, 31TBH5930, 1900 m, on nutlets of *Carex sempervirens* subsp. *sempervirens* Vill., 11-VIII-1994, TAL148, MA-Fungi 32970. Aísa, Barranco del Estarrún, 30TXN9937, 2150 m, on nutlets of *Carex sempervirens* subsp. *sempervirens* Vill., on calcareous pasture, 6-VIII-1995, TAL277, MA-Fungi 34533. Fanlo, cañón de Añisclo, near Fuen Blanca, 31TBH5824, 1500 m, on nutlets of *Carex sempervirens* subsp. *sempervirens* Vill., 14-VIII-1995, TAL283, MA-Fungi 34536. Ansó, Ibón de Estanés, 30TXN9542, 1770 m, on nutlets of *Carex sempervirens* subsp. *sempervirens* Vill., on calcareous pasture, 10-VIII-1995, TAL292, MA-Fungi 34540.

LÉRIDA (L): Alto Arán, Malo stream, near Estanys del Rosari de Baciber, 31TCH32, on nutlets of *Carex sempervirens* subsp. *sempervirens* Vill., 2-VIII-1994, TAL150, MA-Fungi 32972.

Comments: This is the first record of this species from the Iberian Peninsula; we have found it in several localities of the Pyrenees, always on *Carex sempervirens* subsp. *sempervirens* Vill., that grows on calcareous soils. We have never found this smut infecting *C. sempervirens* subsp. *pseudotristis* (Domin) Pawl. which always grows on acid soils.

Entyloma eryngii (Corda) de Bary

Bibliographic records:

HUESCA (Hu): Durrieu (1966), on *Eryngium campestre* L., [MA-Fungi 32886]!.

Entyloma feurichii K. Krieg.

Bibliographic records:

HUESCA (Hu): Losa Quintana (1970), on *Lathyrus latifolius* L.

Entyloma oreochloae Durrieu

Bibliographic records:

ANDORRA (AND): Durrieu (1966), on *Oreochloa disticha* (Wulfen) Link, [MA-Fungi 32887]!.

***Microbotryum dianthorum** (Liro) H. Scholz & I. Scholz

Bibliographic records:

LÉRIDA (L): Durrieu & Zambettakis (1973), as *Ustilago violacea* (Pers.: Pers.) Roussel. On *Dianthus monspessulanus* L. [*D. hyssopyfolius* subsp. *hyssopyfolius* L.], [MA-Fungi 32877]!.

Specimens examined:

ANDORRA (AND): Escaldes, 31TCH8107, 1400 m, in anthers of *Dianthus carthusianorum* L., 1-VII-1996, TAL373, MA-Fungi 35420.

HUESCA (Hu): Bielsa, portilla de Tella, 31TBH6922, 2070 m, in anthers of **Dianthus benearnensis* Loret, 15-VII-1994, CA3283, MA-Fungi 32966. Bielsa, from Portilla de Tella to Tella, 31TBH6922, 1700 m, in anthers of **Dianthus benearnensis* Loret, 15-VII-1994, TAL112, MA-Fungi 32967. Ordesa, Punta Acuta, in anthers of **Dianthus benearnensis* Loret, 7-VIII-1935, MA-Fungi 33618 [MA 33662]. Panticosa, in anthers of **Dianthus benearnensis* Loret, 1-VIII-1970, MA-Fungi 33619 [MA 409794]. Plan, near the Collado de Cocibirón, road to Collado de Sahún, 31TBH8515, in anthers of *Dianthus hyssopifolius* L., on calcareous soil, 16-VII-1994, SC 13323, MA-Fungi 33637 [MA 544946]. San Juan de la Peña, near the Santuario, 30TXN9208, 1200 m, in anthers of **Dianthus pungens* subsp. *hispanicus,* (Asso) O. Bolós & Vigo, on the road

shoulder, 2-VI-1987, 61-87 ML, MA-Fungi 33662 [MA 452348]. Aísa, Barranco del Estarrún, 30TXN9734, 1750 m, in anthers of *Dianthus* cf. *benearnensis* Loret, on calcareous soil, 6-VIII-1995, TAL273, MA-Fungi 34531. Fanlo, 3 km close to the village, 30TYN4318, 1150 m, in anthers of *Dianthus hyssopifolius* L., on the road shoulder, 13-VIII-1995, TAL281, MA-Fungi 34534. Fanlo, cañón de Añisclo, near Fuen Blanca, 31TBH5824, 1650 m, in anthers of *Dianthus hyssopifolius* L., on calcareous soil, 14-VIII-1995, TAL282, MA-Fungi 34535.
LÉRIDA (L): Estana, 31TCG9085, 1400 m, in anthers of *Dianthus carthusianorum* L., on pasture, 29-VI-1996, TAL357, MA-Fungi 35416. Cava, Ansovell, 31TCG8385, 1460 m, in anthers of *Dianthus carthusianorum* L., 29-VI-1996, TAL367, MA-Fungi 35419.

Comments: This is the first record of this species for Spain. Probably it has been confused until now with *M. violaceum*. Differences between both species (meshes shape and size), are difficult to see with a light microscope. It is usually necessary the use of a scanning microscope.

Microbotryum violaceum (Pers.: Pers.) G. Deml & Oberw.
Bibliographic records:
GERONA (Ge): Llistosella & Aguasca (1986), as *Ustilago violacea* (Pers.: Pers.) Roussel, (no host is given).
HUESCA (Hu): Fernández Riofrío (1929), as *Ustilago violacea* (Pers.: Pers.) Fuckel, on *Dianthus monspessulanus* L., [*D. hyssopyfolius* subsp. *hyssopyfolius* L.], Durrieu (1966), as *Ustilago violacea* (Pers.: Pers.) Roussel, on *Silene nutans* L. and on *Silene saxifraga* L.
LÉRIDA (L): Durrieu (1966), as *Ustilago violacea* (Pers.: Pers.) Roussel, on *Silene saxifraga* L., [MA-Fungi 32874]!.
Specimens examined:
HUESCA (Hu): Aísa, Barranco del Estarrún, 30TXN9734, 1750 m, in anthers of *Silene vulgaris* (Moench) Garcke, on pasture on calcareous soils, 6-VIII-1995, TAL274, MA-Fungi 34532. Aneto, near Estany de Llauset, 31TCH1017, 2180 m, in anthers of **Arenaria multicaulis* auct. [*A. moehringioides* J.Murr.], in sunny slope, 17-VIII-1984, MA-Fungi 34543 [MA 408799].
LÉRIDA (L): Val d'Arán, Cazau, 1100 m, in anthers of *Silene saxifraga* L., on calcareous rocks, 22-VIII-1933, MA-Fungi 33703 [MA 31471].

Schizonella cocconii (Morini) Liro
Specimens examined:
*HUESCA (Hu): Sopeira, 31TCG18, in leaves of *Carex flacca* Schreb., 7-VI-1966, MA-Fungi 32887.
*LÉRIDA (L): Cava, Ansovell, 31TCG8385, 1460 m, in leaves of *Carex halleriana Asso* 29-VI-1996, TAL359, MA-Fungi 35417.

Schizonella melanogramma (DC.) J. Schröt.
Bibliographic records:
HUESCA (Hu): Losa Quintana (1970), on *Carex sempervirens* subsp. *granitica* (Braun-Blanq.) C. Vicioso [*Carex sempervirens* subsp. *pseudotristis* (Domin) Pawl.].
Specimens examined:
*GERONA (Ge): Nuria, Noufonts valley, 30TDG3195, 2240 m, in leaves of *Carex caryophyllea* Latourr., on pastures, 28-VI-1996, TAL348, MA-Fungi 35415.
HUESCA (Hu): Bielsa, northern slope of Portilla de Tella, 31TBH7022, 1600 m, in leaves of *Carex ornithopoda* Willd., 15-VII-1994, TAL97, MA-Fungi 32962.
*LÉRIDA (L): Vielha-Mijarán, Bielh de Toro, near Vielha, 31TCH12, 2300 m, in leaves of *Carex sempervirens* Vill., 26-VII-1990, MA-Fungi 32867.

Sorosporium saponariae F. Rudolphi

Bibliographic records:

HUESCA (Hu): Losa España (1949), on *Silene saxifraga* L. and on *Silene nutans* L.

LÉRIDA (L): Durrieu (1962), as *Sorosporium silenis-inflatae* (Zigno) Cif., on *Silene inflata* Sm. [*S. vulgaris* (Moench) Garcke], [MA-Fungi 32885]!.

Sporisorium andropogonis (Opiz) Vánky

Bibliographic records:

BARCELONA (B): González Fragoso (1917), as *Sphacelotheca ischaemi* (Fuckel) G.P. Clinton, on *Andropogon hirtus* L. [*Hyparrhenia hirta* (L.) Stapf.].

HUESCA (Hu): Urríes (1944), as *Sphacelotheca ischaemi* (Fuckel) G.P. Clinton, on *Andropogon hirtus* L. [*Hyparrhenia hirta* (L.) Stapf.], [MA-Funhist 17307]!.

LÉRIDA (L): Durrieu (1966), as *Sphacelotheca andropogonis* (Opiz) Bubák, on *Andropogon ischaemum* L. [*Dichantium ischaemum* (L.) Roberty].

Sporisorium polliniae (Magnus) Vánky

Bibliographic records:

ANDORRA (AND): Llorens (1985), as *Sorosporium icosiense* Maire, on *Andropogon distachyos* L.

Tilletia contraversa J. G. Kühn

Bibliographic records:

GERONA (Ge): Unamuno (1941), on *Agropyrum diazi* Sennen.

Specimens examined:

HUESCA (Hu): Barbuñales, in ovaries of *Hordeum murinum* L., 22-VII-1944, Ma-Funhist 17341.

Tilletia laevis J.G. Kühn

Bibliographic records:

HUESCA (Hu): Urríes (1959), as *Tilletia foetida* (Wallr.) Liro, on *Triticum* sp.

Tilletia sphaerococca (Wallr.) A. A. Fisch. Waldh.

Bibliographic records:

GERONA (Ge): González Fragoso (1917), as *Tilletia decipiens* (Pers.) G. Winter, on *Agrostis pumila* L. [*A. capillaris* Desf.], [MA-Funhist 17338]!.

Tolyposporium aterrimum (Tul. & C. Tul.) Dietel

Bibliographic records:

NAVARRA (Na): Losa Quintana (1970), as *Thecaphora aterrima* Tul. & C. Tul., on *Carex halleriana* Asso.

Tolyposporium junci (J. Schröt.) Woronin ex J. Schröt.

Bibliographic records:

GERONA (Ge): González Fragoso (1919), on *Juncus bufonius* L.

Urocystis anemones (Pers.: Pers.) G. Winter

Specimens examined:

*LÉRIDA (L): Alto Arán, between Salardú and Tredos, close the Garona river, 31TCH23, in leaves of *Anemone nemorosa* L., 2-V-1980, MA-Fungi 32860.

Urocystis floccosa (Wallr.) D.M. Hend.

Bibliographic records:

GERONA (Ge): Fernández Riofrío (1922), as *Urocystis anemones* (Pers.: Pers.) G. Winter, on *Helleborus viridis* L., [MA-Funhist 16986]!.

HUESCA (Hu): Fernández Riofrío (1929), as *Tuburcinia hellebori-viridis* (DC.) Liro, on *Helleborus viridis* L. Losa España (1949), as *Tuburcinia hellebori-viridis* (DC.) Liro, on *Helleborus viridis* L.

LÉRIDA (L): González Fragoso (1927), as *Tuburcinia hellebori-viridis* (DC.) Liro, on *Helleborus viridis* L., [MA-Funhist 16975]!.

Specimens examined:

HUESCA (Hu): Aísa, Barranco del Estarrún, 30TXN9734, 1530 m, in leaves and stems of *Helleborus viridis* L., on pasture, on calcareous soil, 6-VIII-1995, TAL269, MA-Fungi 34529. Ansó, Ibón de Estanés, 30TXN9542, 1770 m, in leaves of *Helleborus viridis* L., on pasture on calcareous soil, 10-VIII-1995, TAL293, MA-Fungi 34541. Fanlo, cañón de Añisclo, to the Fuen Blanca, 31TBH5824, 1740 m, in leaves and stems of *Helleborus viridis* L., on pasture on calcareous soil, 14-VIII-1995, TAL286, MA-Fungi 34538.

LÉRIDA (L): Espot, Monestero stream, 31TCH3616, 2000 m, in leaves of *Helleborus viridis* L., 6-VII-1994, TAL116, MA-Fungi 32969.

*NAVARRA (Na): Isaba, Refugio Militar General Garrido, 30TXM7656, 1250 m, in leaves and stems of *Helleborus viridis* L., 12-VII-1994, TAL70, MA-Fungi 32959. Isaba, road to France, karst de Larra, 30TXN8159, 1700 m, in leaves of *Helleborus viridis* L., on calcareous soil, 12-VII-1994, TAL75, MA-Fungi 32960.

***Urocystis leimbachii** G. Örtel

Specimens examined:

HUESCA (Hu): Benasque, collado de Basibé, 31TCH01, 2400 m, in stems of *Adonis pyrenaica* DC., 14-IX-1978, MA-Fungi 32868.

Comments: Vánky (1994), recorded *Urocystis leimbachii* from Spain, but he didn't indicate the locality. We don`t know any other record of *U. lembachii* from Spain.

Urocystis magica Pass. in Thümen

Bibliographic records:

GERONA (Ge): González Fragoso (1924), on *Allium sativum* L., as *Urocystis cepulae* Frost.

***Urocystis primulicola** Magnus

Specimens examined:

HUESCA (Hu): Ansó, Valle de los Sarrios, near Olibón, 30TXN9641, 1900 m, in ovaries of *Primula veris* L., 10-VIII-1995, TAL294, MA-Fungi 34542.

Comments: This is the first record of *U. primulicola* on *Primula veris*. Only *U. primulae* (Rostr.) Vánky was known on this host. However, morphological and biometric characters fit better the description of *U. primulicola*: Spore balls 32-55 x 31-60 µm, spores: 6.5-11 x 12-21µm, sterile cells: 5-9 x 7-15 µm (Figure 2.b).

Urocystis ranunculi (Lib.) Moesz

Bibliographic records:

HUESCA (Hu): González Fragoso (1919), as *Urocystis anemones* (Pers.: Pers.) G. Winter, on *Ranunculus* sp., [MA-Funhist 16982]!.

Urocystis sorosporioides Körn.

Bibliographic records:

HUESCA (Hu): Durrieu (1964), as *Tuburcinia sorosporoides* (Körn.) Liro, on *Thalictrum alpinum* L.

Urocystis syncocca (L. A. Kirchn.) B. Lindeb.

Bibliographic records:

GERONA (Ge): Heim (1934), on *Hepatica triloba* Chaix [*H. nobilis* Schreb.].

Specimens examined:

*HUESCA (Hu): Jaca, Monasterio de San Juan de la Peña, 30TXN90, in leaves of *Hepatica nobilis* Schreb., 13-VI-1963, MA-Fungi 32864. Jaca, La Peña de Oroel, northern slope, 30TYN00, in leaves of *Hepatica nobilis* Schreb., VII-1971, MA-Fungi 32866. Loarre, monte Pusilibro, 30TXM99, in leaves of *Hepatica nobilis* Schreb., 14-VI-1963, MA-Fungi 32859.

*LÉRIDA (L): Cava, Ansovell, 31TCG8385, 1460m, in leaves and stems of *Hepatica nobilis* Schreb., 29-VI-1996, TAL362, MA-Fungi 35418.

Ustilago avenae (Pers.) Rostr.

Bibliographic records:

NAVARRA (Na): González Fragoso (1922), on *Avena orientalis* Schreb. [A. *sativa* subsp. *sativa* L.].

Ustilago bistortarum (DC.) Körn.

Bibliographic records:

HUESCA (Hu): Lázaro e Ibiza (1913), on *Polygonum bistorta* L.

LÉRIDA (L): Durrieu (1966), as *Sphacelotheca ustilaginea* (DC.) Liro, on *Polygonum viviparum* L.

Specimens examined:

HUESCA (Hu): Bielsa, northern slope of Portilla de Tella, 31TBH6922, 1745 m, in flowers of *Polygonum viviparum* L., 15-VII-1994, TAL101, MA-Fungi 32964.

Ustilago bosniaca Beck

Bibliographic records:

ANDORRA (AND): Losa España & Montserrat (1950), as *Sphacelotheca bosniaca* (Beck) Maire, on *Polygonum alpinum* All. Durrieu (1966), as *Sphacelotheca bosniaca* (Beck) Maire, on *Polygonum alpinum* All.

GERONA (Ge): González Fragoso (1915), as *Sphacelotheca bosniaca* (Beck) Maire, on *Polygonum alpinum* All., [MA-Funhist 17303]!. Llorens (1985), as *Sphacelotheca bosniaca* (Beck) Maire, on *Polygonum alpinum* All.

LÉRIDA (L): Llorens (1985), as *Sphacelotheca bosniaca* (Beck) Maire, on *Polygonum alpinum* All.

Ustilago bullata Berk.

Bibliographic records:

HUESCA (Hu): Urríes (1932), as *Ustilago bromivora* (Tul. & C. Tul.) A.A. Fisch. Waldh., on *Bromus madritensis* L.

Ustilago cynodontis (Henn.) Henn.

Bibliographic records:

GERONA (Ge): González Fragoso (1919), as *Ustilago nebrodensis* Gonz.Frag., on *Melica nebrodensis* Parl. [*M. ciliata* subsp. *ciliata* L.], [The host plant is *Cynodon dactylon* (L.) Pers., MA-Funhist 16816]!.
HUESCA (Hu): Urríes (1932), on *Cynodon dactylon*, [MA-Funhist 17181]!. Durrieu (1962), on *Cynodon dactylon* (L.) Pers., [MA-Fungi 32869]!.

Comments: González Fragoso (1919: 80) described *Ustilago nebrodensis* Gonz.Frag. as a parasite on *Melica nebrodensis*. We have reviewed the type: [In MA-Funhist 16816!. In ovariis *Melica nebrodensis*, España, Llivia (Gerona), on loco Roca Canal, 1300 m, 22-VIII-1918, F. Sennen]. The host plant is *Cynodon dactylon* (L.) Pers. and the fungus is *Ustilago cynodontis* (Henn.) Henn. Therefore *U. nebrodensis* Gonz.Frag. should be considered a synonym of *U. cynodontis* (Henn.) Henn.

Ustilago duriaeana Tul. & C. Tul.
Bibliographic records:
NAVARRA (Na): Urríes (1942), on *Cerastium glutinosum* Fr. [*C. pumilum* Curtis].

Ustilago hordei (Pers.) Kellerm. & Swingle
Bibliographic records:
HUESCA (Hu): Urríes (1932), on *Hordeum vulgare* L.
LÉRIDA (L): González Fragoso (1919), on *Hordeum vulgare* L., [MA-Funhist 16808]!. Llorens (1985), on *Hordeum vulgare* L.

Ustilago hypodytes (Schltdl.) Fr.
Bibliographic records:
HUESCA (Hu): Durrieu (1962), as *Ustilago agrestis* Syd., on *Agropyron glaucum* Roemer & Schultes [*Elymus hispidus* (Opiz) Melderis], [MA-Fungi 32879]!.

***Ustilago marginalis** (DC.) Lév.
Specimens examined:
HUESCA (Hu): Montanúy, on pasture between Aneto and Llausét, 31TCH11, in leaves of *Polygonum bistorta* L., VII-1990, MA-Fungi 32884.

Comments: *Ustilago marginalis* is very close to *U. pustulata* (DC.) G.Winter. This last species has not been reported yet for the Spanish Pyrenees, where it may well occur, since it has been found on the French side. We have studied a collection identified as *U. pustulata* (FRA: Pyrénées Orientales, Etang de Nohèdes, in leaves of *Polygonum viviparum*, VII-1969, MA-Fungi 32853). In both samples studied, the spore morphology is similar (Figures 2.e and 2.f).

Ustilago maydis (DC.) Corda
Bibliographic records:
BARCELONA (B): Durrieu (1966), on *Zea mays* L. Llorens (1985), on *Zea mays* L.
HUESCA (Hu): Durrieu (1966), on *Zea mays* L.
NAVARRA (Na): Lacoizqueta (1885), on *Zea mays* L.

Ustilago nuda (J. L. Jensen) Kellerm. & Swingle
Bibliographic records:
HUESCA (Hu): Fernández Riofrío (1929), on *Hordeum vulgare* L.

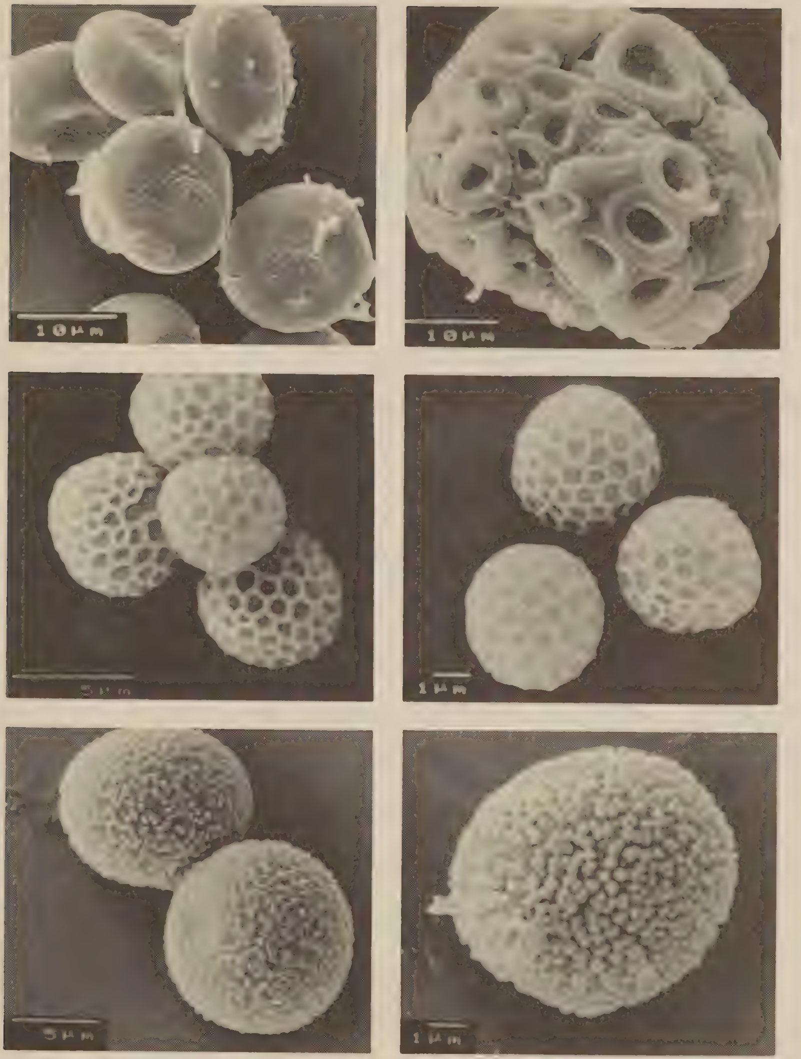

Figure 2: Spores by SEM. a: *Anthracoidea elynae* (Syd.) Kukkonen, MA-Fungi 32892. b: *Urocystis primulicola* Magnus, MA-Fungi 34542. c: *Ustilago vinosa* Tul. & C.Tul., MA-Funhist 17275. d: *Microbotryum dianthorum* (Liro) H.Scholz & I.Scholz, MA-Fungi 33638. e: *Ustilago pustulata* (DC.) G.Winter, MA-Fungi 32853. f: *Ustilago marginalis* (DC.) Lév., MA-Fungi 32884.

NAVARRA (Na): Urríes (1942), on *Hordeum vulgare* L.

Ustilago scabiosae (Sowerby) G. Winter

Bibliographic records:

LÉRIDA (L): Durrieu (1962), [on *Knautia sylvatica*, MA-Fungi 32872]!.

Specimens examined:

LÉRIDA (L): Alto Arán, Tredos, Banys de Tredos, 31TCH32, in anthers of *Knautia* sp., MA-Fungi 32871.

Ustilago scorzonerae (Alb. & Schwein.) J. Schröt.

Specimens examined:

*GERONA (Ge): Cerdanya, near Llers, in flowers of *Scorzonera humilis* L., on humid pasture, 12-VI-1976, MA-Fungi 2042.

Ustilago tragopogonis-pratensis (Pers.: Pers.) Roussel

Bibliographic records:

HUESCA (Hu): Lázaro e Ibiza (1913), as *Ustilago tragopogonis* (Pers.: Pers.) J.Schröt., on *Tragopogon porrifolius* L.

Specimens examined:

HUESCA (Hu): Aísa, Barranco del Estarrún, 30TXN9734, 1560 m, in flowers of *Tragopogon* sp., in pasture on calcareous soil, 6-VIII-1995, TAL271, MA-Fungi 34530.

Comments: The sori destroy the flowers of *Tragopogon* and make imposible to know the host species.

***Ustilago trichophora** (Link) Körn.

Specimens examined:

HUESCA (Hu): Estada, in stems and flowers of *Echinochloa crus-galli* (L.) Beauv., VIII-1945, MA-Funhist 16909 [in sched. as *Cintractia crus-galli,* on *Panicum crus-galli* L.].

Ustilago tritici (Pers.) Rostr.

Bibliographic records:

HUESCA (Hu): Urríes (1932), on *Triticum vulgare* Vill. [*T. aestivum* L.].
LÉRIDA (L): Llorens (1985), on *Triticum* sp.
NAVARRA (Na): Urríes (1942), on *Triticum* sp.

Ustilago vinosa Tul. & C. Tul.

Bibliographic records:

GERONA (Ge): González Fragoso (1915), as *Ustilago vinosa* Tul. & C. Tul., on *Oxyria digyna* (L.) Hill., [MA-Funhist 17275]!.
HUESCA (Hu): Losa Quintana (1972), as *Ustilago vinosa* Tul. & C. Tul., on *Oxyria digyna* (L.) Hill.

Comments: The spores in *U. vinosa* are very close to those of the anthericolous smuts of Caryophyllaceae (Figures 2.c and 2.d). This species also agree with the mentioned group of species, in some biochemical characters. On this basis, Prillinger & al. (1991) placed *U. vinosa* in the genus *Microbotryum*.

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A SYNOPSIS OF MARASMIELLUS IN THE SOUTHERN APPALACHIAN MOUNTAINS

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Abstract: Sixteen taxa of *Marasmiellus* (Agaricales, Tricholomataceae) are reported from the southern Appalachian Mountains based on the examination of type and voucher specimens. *Marasmiellus appalachienensis* is described as a new species, and *Marasmiellus flaccidus* is redescribed. A dichotomous key to aid in diagnosis, citations for sources of comprehensive descriptions and illustrations, and a list of material examined are presented.

Keywords: Agaricales, *Marasmiellus*, southern Appalachian Mountains.

During the course of monographing the genus *Marasmius* (Agaricales, Tricholomataceae) from the southern Appalachian Mts. of southeastern North America (Desjardin 1989, 1990, 1991a-b; Desjardin & Petersen, 1989a-c) numerous specimens of the allied genus *Marasmiellus* were collected, and many herbarium exsiccati and type specimens of *Marasmiellus* were analyzed. More extensive field work, especially along the Gulf Coast, is needed before a comprehensive monographic treatment of the genus from the southeastern US can be attempted. To aid future researchers of marasmioid fungi, a dichotomous key to 16 southern Appalachian species of *Marasmiellus* is presented, supported by a list of voucher specimens examined and citations for sources of comprehensive species descriptions and illustrations. In addition, a commonly encountered but undescribed species is formally described as *Marasmiellus appalachienensis*, and a poorly known rare species, *M. flaccidus*, is redescribed.

The generic and infrageneric delimitations accepted herein are those by Singer (1973, 1986), with the exception of taxa better placed in *Tetrapyrgos* (sensu Horak, 1986). In the descriptions that follow, color terms and notations in parentheses are from Kornerup and Wanscher (1978), while those in quotation marks are from Ridgway (1912). Authors of fungal epithets are abbreviated in accord with Kirk and Ansell (1992). Spore statistics include: $\overline{x}_r$, the range of spore means where $\overline{x}$ is the arithmetic mean of the spore length by spore width for n spores measured in a single sample (specimen); $\overline{x}_m$, the mean of spore means (± SD); Q, the quotient of spore length and spore width in any one spore, indicated as a range of variation in n spores measured; $\overline{Q}_r$, the range of $\overline{Q}$-values where $\overline{Q}$ is the mean of Q-values in a single sample; $\overline{Q}_m$, the mean of $\overline{Q}$-values. Frequently cited collectors are abbreviated as follows: D. E. Desjardin (DED), Harry D. Thiers (HDT), L. R. Hesler (LRH). Only nomenclatural synonyms are provided for each epithet below; for taxonomic synonyms refer to the descriptions cited.

PRELIMINARY KEY TO SOUTHERN APPALACHIAN SPECIES OF *Marasmiellus*

The following artificial dichotomous key is designed to aid in the identification of *Marasmiellus* species occurring in the southern Appalachian Mts. Ecological features presented in the key may not apply elsewhere in the geographical range of the species.

1. Basidiospores > 10.5 µm long 2
1. Basidiospores < 10.5 µm long 6

    2. Pileipellis with scattered, inconspicuous, brown pileosetae .... (sect. *Stenophylloides*) ... 3
    2. Pileipellis lacking brown pileosetae 4

3. (2) Coarse, short, black, wiry rhizomorphs abundant; pileoleptocystidia scattered among the pileosetae; pileus white; basidiospores 13-19(-21) X 4-5.5 µm [$\overline{x}_m$ = 16 X 4.8 µm]; common .... 1. *M. tenerrimus* var. *setulosus*
3. Rhizomorphs and pileoleptocystidia absent; pileus ashy grey; basidiospores 13-18 X 3.2-4.2 µm [$\overline{x}_m$ = 15 X 3.8 µm]; rare .... 2. *M. flaccidus*

4. (2) Basidiomes formed on grass leaves and roots; pileipellis and stipitipellis a well-developed *Rameales*-structure; pleurocystidia absent; basidiospores 8.5-12.5 µm long .... (sect. *Tricolores*) ... 3. *M. tricolor* var. *graminis*

4. Basidiomes formed on dicotyledonous or coniferous debris (never on grasses); pileipellis and stipitipellis of smooth, non-diverticulate hyphae; pleurocystidia large, conspicuous; basidiospores 10.5-15 µm long .... (sect. *Candidi*) ... 5

5. Pileus and lamellae drying white or dingy white; fresh basidiomes with pileus and lamellae becoming pink in age; stipe 5-20 mm long, with a dark brown to black base .... 4. *M. candidus*

5. Entire basidiome drying dark brown to black; fresh basidiomes entirely white, not discoloring pink nor with darkened stipe base; stipe 25-40 mm long .... 5. *M. subnigricans*

6. (1) Stipe eccentric; habit nearly pleurotoid; pileus 10-25 mm diam, white, sulcate; basidiospores 6-11 X 4.5-6 µm; basidiomes formed on monocotyledonous hosts .... (sect. *Marasmiellus* subsect. *Inodermini*) ... . 6. *M. troyanus*

6. Stipe central and habit marasmioid, collybioid or mycenoid; basidiomes not with the above combination of characters 7

7. Stipe reddish brown and with the base attenuated to a very narrow, white point; odor strongly alliaceous to fetid .... (sect. *Tetrachroi*) ... 7. *M. praeacutus*

7. Stipe base not attenuated to a very narrow white point; odor not alliaceous nor fetid 8

8. Pileipellis a well-developed *Rameales*-structure 9

8. Pileipellis lacking a *Rameales*-structure, i.e., hyphae non-diverticulate or with only a few broad knobs or lobes .... (sect. *Dealbati*) ... 14

9. Pileus white overall or with a faintly pigmented disc (yellow to pink), but not pigmented overall 10

9. Pileus pigmented overall (yellowish brown, pinkish brown, reddish brown or brown) 12

10. Basidiomes formed on grass leaves or roots .... (sect. *Tricolores*) ... 3. *M. tricolor* var. *graminis*
10. Basidiomes formed on dicotyledonous or coniferous debris (never on grasses) .... (sect. *Rameales* subsect. *Opacini*) ... 11

11. Basidiomes associated with coarse, buff to greyish brown rhizomorphs; pileus 3-15 mm diam, stipe 10-40 X 0.5-2 mm; basidiospores 7-10 X 3.2-4.5 µm, $\overline{Q}_m = 2.3$; terminal cells of pileipellis on pileus disc broadly clavate to sphaeropedunculate and often thick-walled .... 8. *M. opacus*
11. Basidiomes not forming rhizomorphs; pileus 3-6 mm diam, stipe 2-8 X 0.2-0.5 mm; basidiospores 8.5-11.2 X 2.8-3.5 µm, $\overline{Q}_m = 3.1$; pileipellis a *Rameales*-structure overall, lacking inflated terminal cells .... 9. *M. appalachienensis*

12. (9) Basidiomes associated with coarse, buff to greyish brown rhizomorphs; terminal cells of pileipellis on pileus disc broadly clavate to sphaeropedunculate and often thick-walled .... 8. *M. opacus*
12. Rhizomorphs absent; pileipellis a *Rameales*-structure overall, lacking inflated terminal cells .... (sect. *Rameales* subsect. *Ramealini*) ... 13

13. Pileus yellowish brown to pinkish brown, often with a golden tint; context very thin (<1 mm); stipe 0.2-1 mm diam; basidiospores 2.5-4.5 µm broad; cheilocystidia broadly clavate, with numerous fine diverticula; basidiomes formed on epigeous branches and stems of deciduous trees, shrubs or herbaceous dicots .... 10. *M. ramealis*
13. Pileus dark brown to brown; context 2-4 mm thick; stipe 2-3(-11) mm diam; basidiospores 4.5-7 µm diam; cheilocystidia irregular in outline, often contorted, with nodulose outgrowths; basidiomes formed on hypogeous sticks or roots .... 11. *M. nodosus*

14. (8) Basidiomes formed on monocotyledonous leaves and stems 15

14. Basidiomes formed on dicotyledonous or coniferous debris 16

15. Pileus white overall, lacking a papilla; lamellae close; stipe base ranging from white to pale brown (not orange); rhizomorphs absent; basidiospores 5-8.5 X 2.5-3.5 µm .... 14. *M. dealbatus*
15. Pileus cream with an ochraceous disc, often papillate; lamellae subdistant to distant; stipe base brownish orange (portions of stipe in fresh material always orange); with a few short, brownish orange rhizomorphs associated with basidiomes; basidiospores 7-10 X 3-4.5 µm .... 12. *M. vaillantii*

16. (14) Pileipellis with lanceolate-rostrate to attenuated-fusiform terminal cells up to 80 µm long; lamellae arcuate-decurrent; basidiospores 7-10 X 3.5-4.5 µm; pileus pinkish brown with a darker disc .. 13. *M. omphaliformis*
16. Pileipellis lacking long, attenuated terminal cells; lamellae adnate; basidiospores and pileus variable 17

17. Basidiospores 3-4.5 µm broad; cheilocystidia with 3-8 broad, finger-like to bladder-like appendages; pileus often papillate; basidiomes associated with a few short, brownish orange rhizomorphs .... 12. *M. vaillantii*
17. Basidiospores 2.5-3.5 µm broad; cheilocystidia with few, small, narrow diverticula or apical knobs; pileus not papillate; rhizomorphs absent 18

18. Basidiospores 4.5-6 µm long; stipe 5-8 mm long .... 15. *M. synodicus*
18. Basidiospores 6.5-8 µm long; stipe 6-15 mm long .... 16. *M. stenophyllus*

ENUMERATION OF TAXA

Marasmiellus Murrill, N. Amer. Fl. 9: 243. 1915.

sect. ***Stenophylloides*** Singer, Beih. Nova Hedwigia 44: 73. 1973.

1. *Marasmiellus tenerrimus* var. *setulosus* (Joss. & A. H. Sm.) Desjardin, Mycol. Res. 97: 112. 1993.

≡ *Marasmius candidus* var. *setulosus* Joss. & A. H. Sm., Mycologia 33: 496. 1941.

≡ *Marasmiellus setulosus* (Joss. & A. H. Sm.) Singer, Agar. Mod. Tax.: 319. 1975 (comb. invalid, Art. 33.2, ICBN)

Selected Descriptions. Desjardin et al., 1993; Josserand & Smith, 1941.

Specimens Examined. – TENNESSEE: Sevier Co., Gatlinburg, Keener House, 8 Aug. 1938, A. H. Smith 9943 (Holotype, MICH). For a complete list of specimens examined refer to Desjardin et al. (1993).

Commentary. Marasmiellus tenerrimus var. *setulosus* is a common species in the southern Appalachian region, found on sticks of various deciduous trees (*Quercus*, *Liriodendron*) and hemlock [*Tsuga canadensis* (L.) Carr.]. It is commonly misdiagnosed as *M. candidus* (Bolt.) Singer, a species that is common in western and northern Europe, and western and northeastern North America, but rare in southeastern United States. Data on culture morphology, mating behavior, and allied taxa are provided in Desjardin et al. (1993).

2. *Marasmiellus flaccidus* (A. H. Sm. & Hesler) Desjardin & Halling, Mycol. Res. 97: 117. 1993.

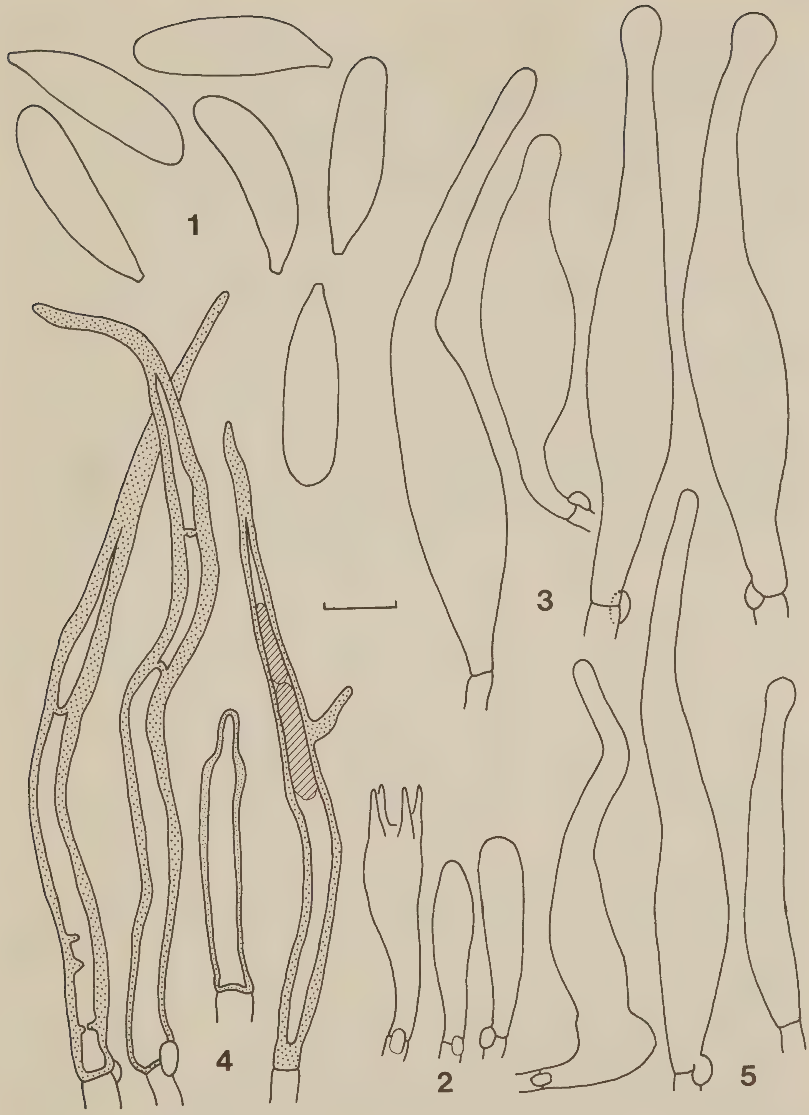
≡ *Collybia flaccida* A. H. Sm. & Hesler, J. Elisha Mitchell Soc. 56: 306. 1940.

FIGS. 1-5

Selected Descriptions: Smith & Hesler, 1940.

Fresh material not seen. Macroscopic features compiled from notes accompanying the specimens examined.

Pileus 5-15 mm diam, convex to broadly convex, becoming convex-depressed to plane in age; margin even, incurved at first, becoming decurved in age; surface dry, densely silky-fibrillose; dark ashy grey (near “Smoke Gray” or “Light Grayish Olive”) when moist, fading in age to very pale ashy grey. Context thin, membranous, flaccid, pallid. Odor and taste not distinctive. Lamellae adnate to subdecurrent, distant to subdistant with 0-1 series of lamellulae, very narrow (<1 mm), often anastomosing near pileus margin, not or weakly intervenose in age, pale ashy grey; edges pruinose, concolorous. Stipe 6-20 X 0.5-1 mm, central, terete, equal, lax, solid, pubescent, insititious, white to buff overall (not darkly pigmented basally); rhizomorphs absent.



FIGS. 1-5. *Marasmiellus flaccidus* (A. H. Smith 14873, Holotype) 1. Basidiospores. 2. Basidium and basidioles. 3. Hymenial cystidia. 4. Pileosetae. 5. Caulocystidia. Scale bar = 5 µm for FIG. 1; 10 µm for FIGS. 2-5.

Basidiospores (FIG. 1) 12-18 X 3.2-4.2 µm [$\bar{x}_r$ = 14.1-16.0 X 3.8-3.9 µm, $\bar{x}_m$ = 15.1 ± 0.7 X 3.8 ± 0.1 µm, Q = 3.2-4.8, $\bar{Q}_r$ = 3.7-4.1, $\bar{Q}_m$ = 3.9 ± 0.2, n = 20 spores per 3 collections], clavate, subcylindrical or subfusoid, often slightly curved in profile, smooth, hyaline, inamyloid. Basidia (FIG. 2) 20-30 X 6.5-9 µm, clavate, 4-spored. Basidioles clavate, not fusoid. Hymenial cystidia (FIG. 3) common on or near the lamellar edges (cheilocystidia), less common on lamellar faces (pleurocystidia), 43-90 X 8-14.5 µm, subcylindrical, lageniform, ventricose or ventricose-rostrate, sometimes subcapitate, obtuse, hyaline, inamyloid, thin-walled, readily collapsing, non-refractive. Pileipellis a cutis with scattered pileosetae; hyphae interwoven to radially arranged, cylindrical, non-diverticulate (no *Rameales*-structure), hyaline to pale yellow, inamyloid, non-gelatinous, non-incrusted; pileoleptocystidia absent. Pileosetae (FIG. 4) scattered, 35-115 X 4.5-8 µm, ranging from short, cylindrical and obtuse, to very long, irregularly cylindrical and attenuated to an acute or subacute apex, unicellular or rarely secondarily septate, subhyaline to melleous or ochraceous, inamyloid; walls up to 3.2 µm thick, the lumen often occluded near the apex, basally clamped, arising from thin-walled, hyaline tramal hyphae. Pileus trama interwoven; hymenophoral trama regular; hyphae 2-8(-14) µm diam, cylindrical or inflated, hyaline, inamyloid, non-gelatinous; with scattered, refractive oleiferous hyphae. Stipe tissue monomitic; cortical and medullary hyphae undifferentiated, parallel to subparallel, 2.5-7 µm diam, cylindrical, hyaline to pale yellow, inamyloid, thin-walled; oleiferous hyphae present. Stipitipellis of scattered caulocystidia (FIG. 5), similar to the hymenial cystidia. Clamp connections present in all tissues.

Habit, habitat and distribution. Rare, scattered on twigs of grape (*Vitis* sp.) and various other hardwoods. June to August. Tennessee.

Specimens Examined. – TENNESSEE: Blount Co., Great Smoky Mts. Nat. Park (GSMNP), Cades Cove, 17 Aug. 1939, A. H. Smith 14873 (Holotype, MICH); Knox Co., Dean's Woods near Knoxville, 11 June 1938. LRH (TENN 11489); Sevier Co., GMNSP, Mt. Le Conte, 8 Aug. 1941, LRH (TENN 13924).

Commentary. Marasmiellus flaccidus is apparently a rare species, known at present from the three specimens cited above. It is very similar to the sympatric taxon *M. tenerrimus* var. *setulosus*, differing by the features indicated in the key.

sect. *Tricolores* Singer, Beih. Nova Hedwigia 44: 91.1973.

3. *Marasmiellus tricolor* var. *graminis* (Murrill) Singer, Beih. Nova Hedwigia 44: 95. 1973.
≡ *Marasmius graminis* Murrill, N. Amer. Fl. 9: 259. 1915.
≡ *Marasmiellus graminis* (Murrill) Singer & Hauskn., Pl. Syst. Evol. 170: 139. 1990.

Selected Descriptions: Singer, 1973; Singer & Hausknecht, 1990; Antonín & Noordeloos, 1993.

Specimens Examined. – CUBA: Santiago de las Vegas, 1 Jun. 1905, F. S. Earle 375 (Holotype, NY). – TENNESSEE: Knox. Co., Knoxville, 7 July 1987, DED 4340 (SFSU).

Commentary. Marasmiellus tricolor var. *graminis* is uncommon in the southern Appalachian region growing on grass roots and twigs of various shrubs. In the field it is reminiscent of *Tetrapyrgos nigripes* (Schwein.) E. Horak, but the latter differs in formation of tetrapodal basidiospores.

sect. *Candidi* (Bataille) Singer, Sydowia 15: 58. 1961.

4. *Marasmiellus candidus* (Bolton) Singer, Pap. Mich. Acad. Sci. 32: 129. 1948.
≡ *Agaricus candidus* Bolton, Hist. Fung. Halifax 1: 39. 1788.
≡ *Marasmius candidus* (Bolton) Fr., Epicr. Syst. Mycol.: 381. 1838.

Selected Descriptions: Singer, 1973 (as *M. albuscorticis*); Noordeloos, 1983; Desjardin, 1987a; Antonín & Noordeloos, 1993.

Specimens Examined. – NORTH CAROLINA: Haywood Co., between Harmon Den and Maggie Valley exits on Hwy 40, 2 Jul. 1989, DED 4950 (TENN); Orange Co., Chapel Hill, 16 Aug. 1919, Coker 3443 (NCU), 5 Jun. 1922, Coker 5164 (NCU); Orange Co., Chapel Hill, Univ. of North Carolina, 7 Jul. 1917, Coker 2616 (NCU); Orange Co., Chapel Hill, Battle's Park, 9 Jul. 1917, Coker 2623 (NCU), 28 Jun. 1919, Coker 3374 (NCU), 22 Jul. 1920, Coker 4493 (NCU); Orange Co., Chapel Hill, Meeting of the Waters, 16 Jul. 1920, Coker 4425 (NCU). – TENNESSEE: Knox Co., UT Woodlot, Cherokee Dr. S of Knoxville, 15 Sep. 1987, DED 4520 (SFSU). Citations of numerous specimens from western and northeastern North

America available from the author.

Commentary. Marasmiellus candidus is one of the more common species in the genus from western and northeastern North America, but it is uncommon in the southern Appalachian Mts. where most phenetically similar material represents *M. tenerrimus* var. *setulosus*. Most of the North Carolina specimens cited above are from east of the Appalachian Mts.. Mating compatibility studies of sympatric specimens of these two taxa indicate that they belong to distinct biological species (Desjardin et al. 1993).

Marasmiellus candidus is commonly referred to as *M. albuscorticis* (Secr.) Singer (*nom. invalid*) or *Marasmius magnisporus* Murrill (a synonym).

5. *Marasmiellus subnigricans* (Murrill) Singer, Beih. Nova Hedwigia 44: 26. 1973.

≡ *Marasmius subnigricans* Murrill, Bull. Torrey Bot. Club 67: 152. 1940.

≡ *Hemimycena subnigricans* (Murrill) Singer, Sydowia 15: 61. 1961.

Selected Descriptions: Murrill, 1940; Singer, 1973.

Specimens Examined. – ALABAMA: Talladega Nat. Forest, Lake Chinnahu Rec. Area, 23 Jul. 1959, HDT 7177 (SFSU). – FLORIDA: Alachua Co., Gainesville, W. A. Murrill, 1 Jul. 1938 [F17358] (Holotype, FLAS); same locality, W. A. Murrill, 16 Sep. 1932 [F9925], 7 Nov. 1932 [F9937], 8 Nov. 1932 [F9938], 24 Jun. 1938 [F16324] (Paratypes, all FLAS); same locality, W. A. Murrill, 30 Jun. 1942 [F16183], 18 Oct. 1938 [F18285], 14 Jul. 1944 [F19329], 26 Jul. 1939 [F19919], 6 Jul. 1939 [F19922] (Authentic, all FLAS); Alachua Co., Newnan's Lake, W. A. Murrill, 30 Jun. 1938 [F17359] (Paratype, FLAS). – MISSISSIPPI: Ocean Springs, Gulf Coast Research Lab, 13 Jun. 1959, HDT 6209 (SFSU). – SOUTH CAROLINA: Sumter Nat. Forest, 15 Aug. 1958, LRH (TENN 23147). – TENNESSEE: Knox Co., Boart's, 8 Jul. 1962, LRH (TENN 24859), 7 Jul. 1966, LRH (TENN 29178); Knox Co., Norris Dam, 20 Jul. 1958, LRH (TENN 23068); Knox Co., Knoxville, 3 Jun. 1959, LRH (TENN 22995), 23 Jun. 1963, LRH (TENN 25607); Knox Co., Timberlake Rd., 8 Jul. 1956, LRH (TENN 21989), 25 Jul. 1958, LRH (TENN 23049); Knox Co., UT Woodlot S of Knoxville, 15 Sep. 1987, DED 4516 (SFSU), 19 Jul. 1991, DED 5254 (SFSU).

Commentary. Marasmiellus subnigricans is closely allied with *M. candidus* and *M. albofuscus* (Berk. & M. A. Curtis) Singer (the latter known only from Cuba; Singer, 1973), but differs in two significant features: a) the white basidiomes darken to nearly black when dried (less so when air dried) with the necropigment soluble in 3% KOH; and b) the stipes arise from a subiculum-like mat of dense white mycelium that may be quite extensive over the surface of the woody substrate.

sect. *Marasmiellus*, subsect. *Inodermini* Singer, Beih. Nova Hedwigia 44: 222. 1973.

6. *Marasmiellus troyanus* (Murrill) Dennis, Kew Bull. Add. Ser. 3: 31. 1970.
≡ *Marasmius troyanus* Murrill, N. Am. Fl. 9: 263. 1915.
≡ *Collybia troyana* (Murrill) Dennis, Trans. Brit. Mycol. Soc. 34: 452. 1951.

Selected Descriptions: Singer, 1973; Pegler, 1983.

Specimens Examined. – JAMAICA: Cockpit Co., Troy and Tyre, 14 Jan. 1909, W. A. Murrill & W. Harris 572 (Holotype, NY). – LOUISIANA: locality unknown, 21 Aug. 1995, Feibelman 2453 (SFSU). – TENNESSEE: Knox Co., 8 Jul. 1958, A. J. Sharp (TENN 23116).

Commentary. In the southern Appalachian Mts. *M. troyanus* is known at present from a single specimen, but the species is more common along the Gulf Coast. *Marasmiellus troyanus* is phenetically similar to a series of species that are saprotrophic and potentially pathogenic on various monocotyledonous hosts such as palms, sugar cane, taro and maize. Confusion surrounds the distinction of *M. troyanus* from *M. inoderma* (Berk.) Singer (1973), *M. semiustus* (Berk. & M. A. Curtis) Singer (1973), *Marasmius palmivorus* Sharples (1928), and *Marasmius pandanicola* Hennings (1897), and further research is required for taxonomic clarity.

sect. *Tetrachroi* Singer, Beih. Nova Hedwigia 44: 87.1973.

7. *Marasmiellus praeacutus* (Ellis) Halling, Syst. Bot. 12: 401. 1987.
≡ *Marasmius praeacutus* Ellis, Bull. Torrey Bot. Club 6: 76.

1876.

≡ *Collybia praeacuta* (Ellis) Gilliam, Mycotaxon 4: 134. 1976.

Selected Descriptions: Halling, 1983, 1987.

Specimens Examined. – CONNECTICUT: Riverton, Peoples State Park, 25 Sep. 1982, Halling 3526 (SFSU). – MASSACHUSETTS: Amherst, Amherst College Woods, 1 Oct. 1979, Halling 3240 (SFSU); Berkshire Co., Monument Picnic Area, 9 Aug. 1986, DED 4015 (SFSU). – MISSISSIPPI: Ocean Springs, Gulf Coast Research Lab, 9 Jun. 1959, HDT 6085 (SFSU), 13 Jun. 1959, HDT 6213 (SFSU); Perry Co., De Soto Nat. Forest, Black Creek Wilderness Area, 16 Jul. 1987, DED 4356 (TENN). – NEW JERSEY: Gloucester Co., Newfield, Ellis & Everhart, N. Amer. Fungi Exsiccati # 402 (Lectotype *des mihi* apud Halling [1987, ut Holotype], Ellis Collection, NY; Isolectotypes: ex Herb. Barnard College, NY; Underwood Collection, NY; BPI, FH, PH, SFSU). – NORTH CAROLINA: Haywood Co., GSMNP, Cataloochee, 28 Jul. 1935, LRH (TENN 8071); Haywood Co., GSMNP, Waterville, Big Creek Ranger Sta., 21 Jul. 1986, DED 3901 (SFSU); Macon Co., Coweeta Hydrologic Lab, 23 Jul. 1986, HDT 50230 (SFSU); Macon Co., Glenn Falls SW of Highlands, 7 Jul. 1986, DED 3722 (SFSU), 23 Jul. 1986, DED 3919 (SFSU); Macon Co., Harbison Lake, 29 Jul. 1934, LRH (TENN 5156); Macon Co., Highlands, 16 Aug. 1936, LRH (TENN 9260), 20 Jul. 1956, LRH (TENN 22359), 9 Aug. 1966, LRH (TENN 29253), 6 Jul. 1986, DED 3712 (SFSU), 22 Jul. 1986, HDT 50207 (SFSU), 13 Jul. 1987, DED 4280 (SFSU), 28 Jul. 1987, DED 4399 (SFSU), 12 Jul. 1988, DED 4577 (SFSU); Swain Co., GSMNP, Kephart Prong, 17 Jul. 1991, DED 5246 (SFSU); Transylvania Co., Pisgah Nat. Forest, Black Mt. Trail, 24 Jul. 1986, DED 3950 (SFSU), HDT 50285 (SFSU). – PENNSYLVANIA: Hunt Co., Laurel Run, 12 Aug. 1937, L. O. Overholts (TENN 10812). – TENNESSEE: Blount Co., GSMNP, Cades Cove, 2 Jul. 1934, LRH (TENN 3786, 3787), 4 Jul. 1935, LRH (TENN 7906), 20 Jul. 1966, LRH (TENN 29190), 17 Sep. 1985, DED 3453 (SFSU), 20 Jul. 1986, HDT 50136 & 50139 (SFSU); Blount Co., GSMNP, Cosby, 30 Jul. 1936, LRH (TENN 9079); Blount Co., GSMNP, Elkmont, 9 Aug. 1936, LRH (TENN 9179); Blount Co., GSMNP, Parsons Branch Rd., 7 Jul. 1987, DED 4338 (SFSU), 29 Jul. 1991, DED 5312 (SFSU); Sevier Co., GSMNP, Alum Bluff Cave Trail, 28 Jun. 1986, DED 3689 (SFSU); Sevier Co., GSMNP, Greenbrier, 5 Jul. 1934, LRH (TENN 3785); Sevier Co., GSMNP, Mt. LeConte, 5 Jul. 1934, LRH (TENN 3788), 3 Jun. 1957, LRH (TENN 12340), 8 Jul. 1961, LRH (TENN 24389), 6 Aug. 1963, LRH (TENN 27724); Sevier Co., GSMNP, Roaring Fork Trail, 5 Aug. 1970, LRH (TENN 35630), 9 Jul. 1987, DED 4350 (SFSU).

Commentary. Marasmiellus praeacutus is commonly collected in the southern Appalachians Mts. on needles and twigs of *Pinus* and *Tsuga*, and on leaves or woody debris of *Rhododendron* and various other hardwoods. A strong alliaceous odor and taste, and dark brown, fusoid stipe with a distinctive white, attenuated (pinched), insititious base are diagnostic.

sect. *Rameales* (J. Lange) Singer, Lilloa 22: 299. (1949)1951.
subsect. *Opacini* Singer, Beih Nova Hedwigia 44: 102. 1973.

8. *Marasmiellus opacus* (Berk. & M. A. Curtis) Singer, Lilloa 22: 300. (1949) 1951.
≡ *Marasmius opacus* Berk. & M. A. Curtis, Hooker J. Bot. 1: 99. 1849.

Selected Descriptions: Singer, 1973; Desjardin et al., 1993.

Specimens Examined. – SOUTH CAROLINA: Darlington Co., Society Hill, Jun., Curtis 1241 (Isotype, FH). For a more complete list of specimens examined refer to Desjardin et al. (1993).

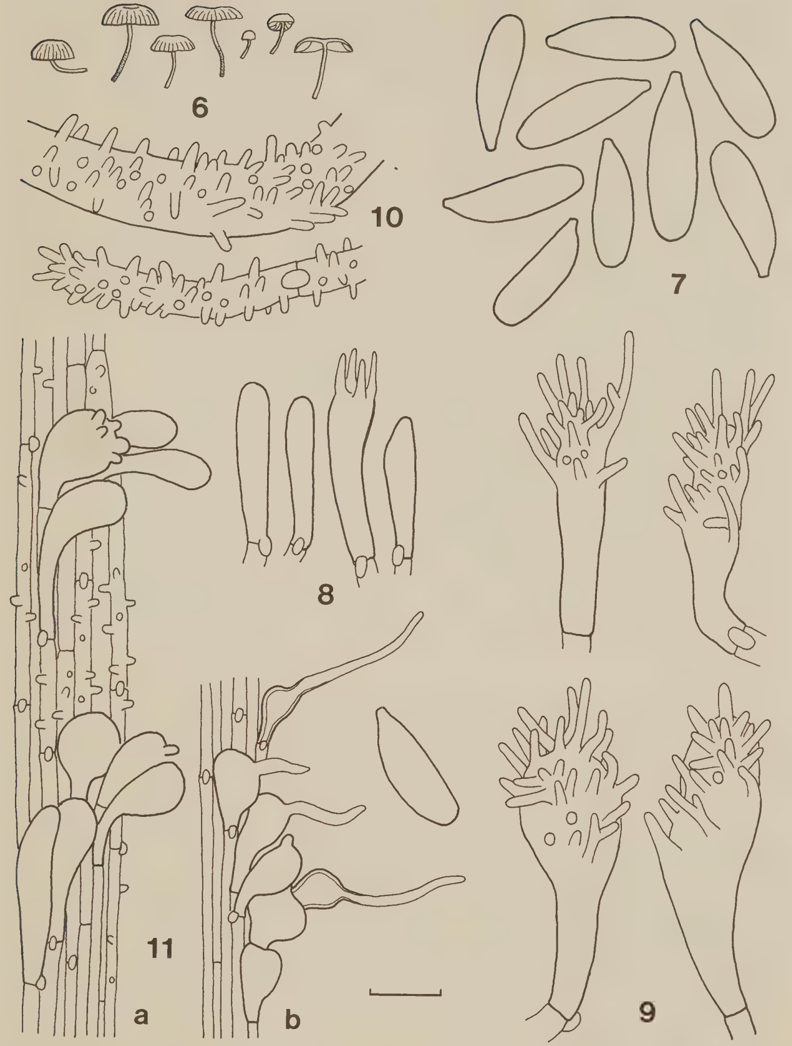
Commentary. Marasmiellus opacus is a commonly encountered rhizomorph-forming agaric, apparently restricted to temperate or subtropical regions of the Northern Hemisphere where it is often locally abundant in riparian habitats in association with *Rhododendron*. Data on culture morphology, mating behavior, and allied taxa are provided in Desjardin et al. (1993).

9. *M. appalachienensis* Desjardin, sp. nov. FIGS. 6-11

Pileus 3-6 mm diam, convexus vel plano-convexus, subdepressus, ruguloso-striatus, glaber, albus. Lamellae adnatae vel subadnexae, subdistantes vel distantes, latae, albidae. Stipes 2-8 X 0.2-0.5 mm, centralis vel subeccentricus, cylindricus, pruinosus vel furfuraceus, insiticius, apicaliter albidae sursum rufobrunneus, rhizomorpha nulla. Odor saporque nulli. Basidiosporae 8.5-11.2 X 2.8-3.5 μm, fusoideae vel angustae ellipsoideae, leves, hyalinae, inamyloideae. Basidia 17.5-23 X 5.5-6.5 μm, tetraspora. Cheilocystidia 24-40 X 7-15 μm, clavatis vel irregulariter cylindraceis; diverticulis apicalibus vel subapicalibus, cylindraceis vel irregularibus, 1.5-12 X 0.5-1.5 μm, instructa. Pleurocystidia nulla. Pileipellis typi Rameales, ex cellulis cylindraceis inamyloideis instructis, 5-10 μm diam, diverticulis cylindraceis, 1.5-8 X 0.5-1 μm, instructis. Trama pilei vel lamellarum inamyloideum, haud gelatinosum. Hyphae stipitis corticales glabrae vel leviter diverticulatae, inamyloideae, apicaliter hyalinae sursum pallide brunneae. Caulocystidia 16-60 X 8-22 µm, late clavata vel vesiculosa, levae vel rariter diverticulis irregularibus instructa, hyalina. Fibulae praesentes. Solitarius, ad lignum putridum Tsugae. North Carolina. D. E. Desjardin 5171 (Holotypus, SFSU; Isotypus, TENN).

Basidiomes (FIG. 6) marcescent. Pileus (1.5-)3-6(-12) mm diam, convex with incurved margin when young, expanding with age to plano-convex with decurved margin, often with a shallow central depression, rarely with a small papilla, striate to rugulose-striate; surface dull, dry to moist, glabrous or minutely granulose to suede-like; pure white overall, seldom developing faint orange white (6A2) or pinkish white (7A2) tones on the disc in age. Context thin (<0.5 mm), white. Odor not distinctive; taste mildly fungal. Lamellae horizontal, adnate to shallowly adnexed, subdistant to distant (11-15) with 1-2 series of lamellulae, moderately broad to broad (0.5-1.5 mm), white to buff; edges entire, granulose, concolorous with the sides. Stipe 2-8(-10) X 0.2-0.5 mm, central to slightly eccentric, terete, equal or with the base sometimes subbulbous, often curved, apex pruinose, base scurfy to furfuraceous, insititious; white overall when young, hysterochroic, base slowly developing incarnate to reddish brown tones, in age apex remaining white to buff and base ranging from pink (7A2) or pale greyish red (8C3-4) to reddish brown (8D-E4-5); rhizomorphs absent.

Basidiospores (FIG. 7) (8-)8.5-11.2(-12) X 2.8-3.5 µm [$\bar{x}_r$ = 9.4-9.9 X 3.0-3.2 µm, $\bar{x}_m$ = 9.7 ± 0.2 X 3.1 ± 0.1 µm, Q = 2.6-3.8, $\bar{Q}_r$ = 3.02-3.26, $\bar{Q}_m$ = 3.13 ± 0.11, n = 20-25 spores per 5 collections], fusoid to elongate-ellipsoid, seldom subcylindrical, smooth, hyaline, inamyloid, thin-walled. Basidia (FIG. 8) 17.5-23 X 5.5-6.5 µm, clavate, 4-spored. Basidioles (FIG. 8) subcylindrical to subfusoid. Pleurocystidia absent. Cheilocystidia (FIG. 9) abundant, lamellar edge sterile, 24-40 X 7-15 µm, clavate or broadly clavate to subcylindrical or irregular in outline, rarely lobed, thin-walled, with numerous subapical to apical diverticula; diverticula 1.5-12(-19) X 0.5-1.5 µm, cylindrical or irregularly cylindrical, obtuse, sometimes branched, hyaline; some specimens having cystidia with consistently short diverticula, other specimens having cystidia with a mixture of short and very long diverticula. Pileipellis (FIG. 10) a well-developed *Rameales*-



FIGS. 6-11. *Marasmiellus appalachienensis* (DED 5171, Holotype). 6. Basidiomes (x1). 7. Basidiospores. 8. Basidium and basidioles. 9. Cheilocystidia. 10. Pileipellis hyphae. 11. Caulocystidia – a) stipe apex; b) stipe base. Scale bar = 5 µm for FIG. 7; 10 µm for FIGS. 8-10; 20 µm for FIG. 11.

structure; hyphae 5-10(-12) µm diam, densely diverticulate, cylindrical to slightly inflated, branched, hyaline, inamyloid, non-gelatinous, non-incrusted, thin-walled; diverticula 1.5-8 X 0.5-1 µm, cylindrical, obtuse, scattered to abundant, hyaline. Pileus trama interwoven; hymenophoral trama regular; hyphae 5-13 µm diam, cylindrical to inflated, hyaline, inamyloid, non-gelatinous, non-incrusted, thin-walled to slightly thick-walled (-0.5 µm). Stipe tissue monomitic; cortical hyphae 4-10 µm diam, parallel, cylindrical, hyaline (apex) to pale yellow or pale brown (base), non-gelatinous, non-incrusted, smooth or diverticulate on stipe apex, smooth on stipe base; medullary hyphae similar to cortical hyphae except all hyaline and smooth. Stipitipellis composed of scattered to clustered caulocystidia; caulocystidia (FIG. 11) 16-60 X 8-22 µm, those on stipe apex clavate, broadly clavate or vesiculose, smooth or with a few broad diverticula, hyaline, thin-walled; those on stipe base similar or often with 1-2 filamentous projections 8-90 µm long, main body of cell thin- to thick-walled. Clamp connections common in all tissues.

Habit, habitat and distribution. Solitary to scattered on twigs of hemlock (*Tsuga canadensis* (L.) Carr.), seldom on bark of *Rhododendron* spp. or *Vitis* sp. in riparian habitats or mixed deciduous forests. June to September. Georgia, North Carolina, Tennessee.

Specimens Examined. – GEORGIA: Rabun Co., Big Creek area near Double Bridges, 11 Jul. 1991, DED 5193. – NORTH CAROLINA: Macon Co., Bull Pen Rd. SE of Highlands, 21 Jul. 1987, DED 4376; Macon Co., Coweeta Hydrologic Lab, Ball Creek, 14 Jul. 1986, DED 3812, 23 Jul. 1986, DED 3936, 12 Jul. 1991, DED 5207; Macon Co., Coweeta Hydrologic Lab, Shope Fork, 10 Jul. 1991, DED 5171 (Holotype SFSU; Isotype, TENN), 8 Jul. 1986, DED 3769, 22 Jul. 1987, DED 4382; Macon Co., Glenn Falls area SW of Highlands, 7 Jul. 1986, DED 3729; Macon Co., Standing Indian Campground, 25 Jun. 1993, DED 5775. – TENNESSEE: Blount Co., GSMNP, Bote Mt. Rd., 20 Jul. 1986, DED 3880; Blount Co., GSMNP, Crib Gap, 5 Jul. 1991, DED 5115; Blount Co., GSMNP, Elkmont, Jakes Creek Trail, 3 Jul. 1991, DED 5102; Blount Co., GSMNP, Parsons Branch Rd., 10 Sep. 1987, DED 4502, 29 Jul. 1991, DED 5303; Sevier Co., GSMNP, Alum Bluff Cave, 28 June 1986, DED 3696. All SFSU except where noted otherwise.

Commentary. Marasmiellus appalachienensis is characterized by the formation of very small basidiomes with pure white pilei, distant lamellae, stipes with a reddish base that are insititious on hemlock twigs (seldom on azalea or grape), long and narrow basidiospores with $\bar{Q}_m = 3.1$, broadly clavate cheilocystidia with numerous fine diverticula, and typically smooth, broadly clavate caulocystidia. The new species belongs in sect. *Rameales* subsect. *Opacini* where it is phenetically similar to *M. humillimus* (Quél.) Singer, *M. petiolorum* (Berk.) Singer, *M. eburneus* (Theiss.) Singer, *M. stenosporus* Singer, and *M. bermudensis* (Berk.) Singer. *Marasmiellus appalachienensis* differs from all of these species in its distinctive caulocystidia. In addition, *M. humillimus*, known at present from Europe, differs in forming smaller basidiomes with slightly smaller basidiospores, no reddish tones on the stipe base, and grows on grasses (*fide* Antonín & Noordeloos, 1993). *Marasmiellus petiolorum*, described from Cuba (Isotype, FH!), differs primarily in forming smaller basidiomes (pilei 1-2 mm diam, stipes 2-4 mm long) and lacks the broadly clavate caulocystidia of *M. appalachienensis*. *Marasmiellus eburneus*, reported from Florida, Central and South America, differs in forming a papillate to umbonate pileus, shorter basidiospores (5.5-8 µm), and lacks broadly clavate caulocystidia (*fide* Singer, 1973). *Marasmiellus stenosporus*, reported only from Bolivia, differs in forming an umbonate pileus with cinnamon buff disc, a chestnut-black stipe, and lacks broadly clavate caulocystidia (*fide* Singer, 1973). *Marasmiellus bermudensis*, reported from Bermuda and Mexico, differs in forming an ochraceous to grey pileus, a pallid stipe lacking reddish tones, shorter and broader basidiospores (5-8.3 X 3-4 µm), and a diverticulate stipe surface lacking caulocystidia (*fide* Singer, 1973).

Marasmiellus appalachienensis is quite common on hemlock twigs in the southern Appalachian Mts., and the small white pilei and reddish brown stipe base in combination with very long and narrow basidiospores and broadly clavate caulocystidia are diagnostic features that clearly distinguish the species from other Marasmielli in the region.

subsect. ***Ramealini*** Singer, Beih. Nova Hedwigia 44: 130. 1973.

10. ***Marasmiellus ramealis*** (Bull.: Fr.) Singer, Pap. Mich. Acad. Sci. 32: 130. (1946) 1948.

≡ *Agaricus ramealis* Bull., Herb. France: pl. 336. 1786.
≡ *Agaricus ramealis* Bull.: Fr., Syst. Mycol. 1: 135. 1821.
≡ *Gymnopus ramealis* (Bull.: Fr.) S. F. Gray, Nat. Arr. Brit. Pl. 1: 611. 1821.
≡ *Marasmius ramealis* (Bull.: Fr.) Fr., Epicr. Syst. Mycol.: 381. 1838.

Selected Description: Antonín & Noordeloos, 1993.

Specimens Examined. – NORTH CAROLINA: Macon Co., Cliffside Lake Campground NW of Highlands, 29 Jul. 1986, DED 3973 (SFSU); Macon Co., Coweeta Hydrologic Lab, Ball Creek, 26 Jun. 1993, DED 5796 (SFSU); Macon Co., Rustic Falls Rd. off Horse Cove Rd., Norton Branch, 10 Aug. 1987, DED 4425 (SFSU), 12 Jul. 1988, DED 4584 (SFSU). – TENNESSEE: Blount Co., GSMNP, Cades Cove, 15 Jun. 1957, LRH (TENN 7867); Knox Co., Timberlake Rd., 7 Aug. 1959, LRH (TENN 23341).

Extralimital Material Examined. – GERMANY: location & collector unknown, Aug. 1928 (UC). – NORWAY: location unknown, 13 Jul. 1877, Holten & Sivertsen (UC). – ITALY: location unknown, July 1901, Eichler (NY). – SWEDEN: Femsjö, Romell, 1911 (NY), 16 Jul. 1961, M. Moser (TENN 25131). – UNITED KINGDOM: N. Devon, Marwood, Whitehall, 9 Sep. 1960, J. P. M. Brenan (TENN 24058).

Commentary. Marasmiellus ramealis is uncommon in the southern Appalachian region, where it grows on small twigs of *Leucothoe*, *Rhododendron*, *Vitis*, or rarely *Tsuga*. Although commonly reported from eastern North America, most herbarium specimens determined as *M. ramealis* represent *M. opacus*. A western variety with narrower basidiospores and very long diverticulate appendages on cheilocystidia was described from California as *M. ramealis* var. *californicus* Desjardin (1987b).

11. *Marasmiellus nodosus* Halling, Syst. Bot. 12: 400. 1987.

Selected Description: Halling, 1987.

Specimens Examined. – NORTH CAROLINA: Macon Co., Coweeta Hydrologic Lab, 14 Jul. 1988, DED 4602 (SFSU), 10 Jul. 1991, DED 5173 (SFSU, TENN). – SOUTH CAROLINA: Oconee Co., Sumter Nat. Forest, Ellicott Wilderness Area, Chattooga Picnic Area, 12 Aug. 1987, DED 4451 (SFSU). – TENNESSEE: Sevier Co., GSMNP, Alum Bluff Cave Trail, 26 Jul. 1988, DED 4627 (SFSU); Sevier Co., GSMNP, trail from Indian Gap to Chimneys, 26 Jul. 1936, LRH (TENN 8954); Sevier Co., GSMNP, near

Newfound Gap, 28 June 1986, DED 3686 (NY); Sevier Co., GSMNP, Roaring Fork Trail, 9 Jul. 1987, DED 4349 (SFSU).

Commentary. First described from material collected on buried sticks in pine and oak forests of Kentucky and southern Illinois (Halling, 1987), *M. nodosus* forms basidiomes on buried roots of *Liriodendron*, *Rhododendron*, and other undetermined deciduous trees in the southern Appalachian Mts.

sect. *Dealbati* Singer, Beih. Nova Hedwigia 44: 33. 1973.
subsect. *Quercini* Singer, Beih. Nova Hedwigia 44: 39. 1973.

12. *Marasmiellus vaillantii* (Pers.: Fr.) Singer, Beih. Nova Hedwigia 44: 313. 1973.
≡ *Agaricus ericetorum* β *vaillantii* Pers., Syn. Meth. Fung.: 472. 1801.
≡ *Agaricus vaillantii* Pers.: Fr., Syst. Mycol. 1: 136. 1821.
≡ *Marasmius vaillantii* (Pers.: Fr.) Fr., Epicr. Syst. Mycol.: 380. 1838.

Selected Descriptions: Singer, 1973; Redhead, 1981; Noordeloos, 1983; Antonín & Noordeloos, 1993.

Specimens Examined. – MASSACHUSETTS: Amherst, 9 Aug. 1986, DED 4014 (SFSU). – NORTH CAROLINA: Haywood Co., GSMNP, Cataloochee, 5 Sep. 1987, DED 4484 (SFSU); Jackson Co., Mulkey Gap at jct. with Bull Pen Rd. S of Cashiers, 12 Aug. 1987, DED 4446 (SFSU); Macon Co., Chattooga Loop Trail, 2 Aug. 1988, DED 4681 (SFSU); Macon Co., Cliffside Lake Campground NW of Highlands, 3 Sep. 1986, DED 4120 (SFSU); Macon Co., Coweeta Hydrologic Lab, Shope Fork, 22 Jul. 1987, DED 4383 (SFSU); Macon Co., Rustic Falls Rd., 13 Aug. 1987, DED 4459 (SFSU); Transylvania Co., Pisgah Nat. Forest, Slide Rock, 24 Jul. 1986, DED 3940 (SFSU). – PENNSYLVANIA: Allegheny Co., Warden Mine, 27 Jun. 1940, L. K. Henry [*ut Marasmius epiphyllus*] (NY). – SOUTH CAROLINA: Oconee Co., Sumter Nat. Forest, Ellicott Wilderness Area, Chattooga Picnic Area, 12 Aug. 1987, DED 4445 (TENN). – TENNESSEE: Blount Co., GSMNP, Cades Cove, 20 Jul. 1986, DED 3879 (SFSU); Blount Co., GSMNP, Elkmont, Jakes Creek Trail, 3 Jul. 1991, DED 5095 & 5096 (SFSU); Blount Co., GSMNP, Gregory Bald Trail, 7 Jul. 1987, DED 4330 (SFSU); Blount Co., GSMNP, Parsons Branch Rd., 29 Jul. 1991, DED 5310 (SFSU); Blount Co., GSMNP, Tremont, 5 Jul. 1991, DED 5129 (SFSU).

Commentary. Marasmiellus vaillantii was first reported from

North Carolina by Curtis (1867) although this material has not been located. The species was subsequently described twice by Peck from material collected in New York, as *Marasmius salignus* Peck (1884; Holotype NYS!) and *Marasmius ramulinus* Peck (1897; Holotype NYS!). Redhead (1981) reported the species from wetland areas in Canada where it forms basidiomes on twigs of *Salix* and *Alnus*, and on leaves and culms of *Carex* and *Juncus*. In the southern Appalachian Mts., *M. vaillantii* grows both in wetland environments on leaves of ferns (*Osmunda*) and grasses (*Carex*) or on twigs or bark of *Alnus* and *Salix*, and in drier forests on twigs or bark of *Fagus*, *Liriodendron*, *Platanus*, *Pinus*, and *Tsuga*.

13. *Marasmiellus omphaliformis* (Kühner) Noordeloos, Persoonia 12: 35. 1983.

≡ *Maramius omphaliformis* Kühner, Bull. Soc. Nat. Oyonnax 8: 111. 1954.

≡ *Hydropus omphaliformis* (Kühner) Honrubia, Cryptog. Mycol. 5: 58. 1984.

Selected Descriptions: Malençon & Bertault, 1975; Noordeloos, 1983; Antonín & Noordeloos, 1993.

Specimens Examined. – NORTH CAROLINA: Macon Co., Rustic Falls Rd. SE of Highlands, Norton Branch at jct. with Big Creek, 10 Aug. 1991, DED 4421 & DED 4426 (SFSU); Macon Co., Standing Indian Campground, 25 Jun. 1993, DED 5773; Swain Co., GSMNP, Kepart Prong, 19 Jul. 1988, DED 4609 (SFSU). – TENNESSEE: Blount Co., GSMNP, Bote Mt. Rd., 18 Jun. 1989, DED 4910 (SFSU); Blount Co., GSMNP, Crib Gap, 5 Jul. 1991, DED 5128 (SFSU); Knox Co., Ball Camp Pike near Knoxville, 19 Aug. 1934, LRH (TENN 5450); Knox Co., Knoxville, 21 Jun. 1989, DED 4916 (SFSU).

Commentary. Although Noordeloos (1983) cited examination of an authentic specimen (R. Kühner, 2 Sept. 1935 [PC]), this specimen is apparently no longer available. In their recent monograph of European marasmioid fungi, Antonín & Noordeloos (1993) report that no type specimen of *M. omphaliformis*, described from France, was preserved and they did not designate a neotype specimen. My concept of the species is that of Malençon and Bertault (1975) and Noordeloos (1983). It should be noted that the micromorphology detailed in the European monograph cited above was derived from analysis of two specimens collected in the Great Smoky Mts. National Park by Antonín and Desjardin. The species is uncommon in the southern Appalachian Mts. where it forms basidiomes on decaying woody debris or bark of deciduous trees (*Carpinus*, *Liriodendron*, *Quercus*) and conifers (*Pinus*, *Tsuga*).

subsect. *Dealbatini* Singer, Beih. Nova Hedwigia 44: 34. 1973.

14. *Marasmiellus dealbatus* (Berk. & M. A. Curtis) Singer, Sydowia 15: 58. 1961. [Sydowia 9: 391. 1955 – invalid comb.]
≡ *Marasmius dealbatus* Berk. & M. A. Curtis, J. Linn. Soc., Bot. 10: 296. 1869.
≡ *Collybia dealbata* (Berk. & M. A. Curtis) Dennis, Trans. Brit. Mycol. Soc. 34: 445. 1951.

Selected Descriptions: Singer, 1973; Pegler, 1983.

Specimens Examined. – NORTH CAROLINA: Macon Co., Highlands, 8 Jul. 1991, DED 5147 (SFSU).

Commentary. Marasmiellus dealbatus is a pathogen of grasses and has been reported as common throughout the neotropics. It is currently known from the southern Applachian Mts. by a single specimen collected on grasses at Highlands Biological Station.

15. *Marasmiellus stenophyllus* (Mont.) Singer, Sydowia 15: 58. 1961.
≡ *Marasmius stenophyllus* Mont., Ann. Sci. Nat. Bot. 4(1): 116. 1854.

Selected Descriptions: Montagne, 1854; Singer, 1973; Pegler, 1983.

Specimens Examined. – FLORIDA: Alachua Co., Gainesville, 21 Oct. 1932, W. A. Murrill [F9932] (Holotype of *Marasmius subsynodicus*, FLAS); Dade Co., Matheson Hammock, 21 Sep. 1942, Singer F802 (FH). – TENNESSEE: Knox Co., Timberlake Rd., 17 Jul. 1956, LRH (TENN 22375).

Commentary. Described initially from French Guiana (Montagne, 1854), *M. stenophyllus* was first reported from North America (Florida) by Murrill (1940) as *Marasmius subsynodicus*

Murrill. After studying the holotype specimens of both taxa, Singer (1973) and Pegler (1983) accepted *M. subsynodicus* and *M. stenophyllus* as synonyms. I have not studied the type of *M. stenophyllus* , but I have studied the type of *M. subsynodicus* (FLAS!) and I am following Singer and Pegler in accepting the two taxa as synonyms. The type specimen of *M. subsynodicus* and a second specimen from Florida are conspecific with the specimen from Tennessee cited above.

16. ***Marasmiellus synodicus*** (Kunze) Singer, Sydowia 15: 57. 1961. [Sydowia 9: 390. 1955 – invalid comb.]
≡ *Agaricus synodicus* Kunze in Fr., Linnaea 5: 507. 1830.
≡ *Marasmius synodicus* (Kunze) Fr., Epicr. Syst. Mycol.: 381. 1838.

Selected Descriptions: Singer, 1973; Pegler, 1983.

Specimens Examined. – Tennessee: Knox. Co., Knoxville, UT Woodlot, 19 Jul. 1991, DED 5258 (SFSU); Knox Co., Knoxville, 31 Jul. 1963, C. D. Sherbakoff (SFSU, TENN 25787).

Commentary. The two specimens cited above match quite closely the descriptions of *M. synodicus* reported by Singer (1973) and Pegler (1983). The species is essentially indistinguishable from *M. stenophyllus* except for the slightly shorter stipe and smaller basidiospores of *M. synodicus*.

EXCLUDED TAXA

Marasmiellus nigripes (Schwein.) Singer, Pap. Michigan Acad. Sci. 32: 130. 1948.
≡ *Agaricus nigripes* Schwein., Schr. Nat. Ges. Leipzig 1: 84. 1822.
≡ *Marasmius nigripes* (Schwein.) Fr., Epicr. Syst. Mycol.: 383. 1838.
≡ *Heliomyces nigripes* (Schwein.) Morgan, J. Mycol. 12: 93. 1896.
≡ *Pterospora nigripes* (Schwein.) Horak, Sydowia 36: 133. 1983.
≡ *Tetrapyrgos nigripes* (Schwein.) Horak, Sydowia 39: 102. 1986.

I follow Horak (1986) and accept *M. nigripes* in the segregate genus *Tetrapyrgos*. *Tetrapyrgos nigripes* (Schwein.) Horak is quite common throughout the southeastern US and is distinguished by a pure white pileus and lamellae contrasting with a black or dark bluish grey, pruinose stipe, in combination with triangular to tetrapodal basidiospores and densely diverticulate dermatocystidia with smooth, bulbous apices. Refer to Singer (1973; as *M. nigripes*) and Desjardin et al. (1992) for descriptions and commentaries.

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COMPATIBILITY GROUPS, SPECIES CONCEPTS AND NOMENCLATURE IN EUROPEAN *ARMILLARIA* SPECIES[1]

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ABSTRACT

A primarily phenotypic species concept in macrofungi does not necessarily distinguish 'species' that can only be recognized after compatibility experiments. This discrepancy may lead to some taxonomic and nomenclatural problems, as exemplified by the European intersterility groups (ISG) B and E of *Armillaria*, which have been named *A. cepistipes* and *A. lutea* (= *A. gallica*), respectively. According to morphological criteria, these taxa can better be united into a single species, *A. lutea*. The intersterility group (ISG), if determined, can for instance be indicated by using the symbols originally used by Korhonen. Thus, we suggest that suitable citations for *A. cepistipes* and *A. lutea* would be *A. lutea* Gillet ISG B (Korhonen, 1978) and *A. lutea* Gillet ISG E (Korhonen, 1978), respectively.

The nomenclature of taxa, distinguished by incompatibility tests, is necessarily based on a comparison between the phenotypic characters of these taxa and previous descriptions in the literature. This practice has led to controversies in the nomenclature of European *Armillaria* species. Some remarks on these problems are made.

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KEYWORDS: *Armillaria*, intersterility group, species concept, taxonomy, nomenclature.

INTRODUCTION

With the increasing use of compatibility tests for discerning biological species within phenotypic species complexes, nomenclatural complications have arisen. Taxonomic and nomenclatural problems ensuing after the discovery of compatibility groups are exemplified here for the *Armillaria mellea* complex.

Korhonen (1978a) reported the existence of five sexual compatibility groups (or intersterility groups, abbreviated ISG) in European isolates of the annulated *Armillaria* species. He mentioned several ecological and morphological differences between the ISG's, named A, B, C, D and E, but did not assign formal names to them. This was done later by other authors, after thorough morphological and taxonomic research (e.g. Marxmüller, 1982, 1987; Watling & al., 1982; Termorshuizen & Arnolds, 1987). ISG's A, C and D were easily distinguishable using morphological characteristics, and the names *A. borealis* Romagn. & Marxm., *A. ostoyae* (Romagn.) Herink, and *A. mellea* (Vahl : Fr.) Kumm. are widely accepted for these taxa. However, morphological differences between ISG B (named *A. cepistipes* Velen.) and E (named *A. lutea* Gillet, *A. bulbosa* (Barla) Kile & Watl. or *A. gallica* Marxm. & Romagn.) are not significant.

It is widely recognized that morphological identification of the two incompatibility groups B and E in *Armillaria* is unreliable (Marxmüller, 1987; Termorshuizen & Arnolds, 1987). The vague morphological differences between *A. cepistipes* and *A. lutea* may also have led to the recent debate on the correct name for Korhonen's (1978a) ISG E (Termorshuizen & Arnolds, 1987; Marxmüller, 1992, Intini, 1996). Several Dutch collections of fresh specimens that showed the typical characteristics of *A. cepistipes* (pale cap, scales on the cap only in the centre, no scales or floccules on the stem, cf. Marxmüller, 1987) were later identified in compatibility tests (kindly performed in 1993 by B. van Dam, Institute for Forest

Tree and Nature Research, Wageningen, unpublished) as *A. lutea*. The question arises how these incompatibility groups which lack reliable phenotypic characters should be treated in taxonomic and nomenclatural respect.

SPECIES CONCEPTS AND INCOMPATIBILITY GROUPS

A phenotypic species is characterized by morphological, physiological or biochemical features. For fungi producing large fruiting bodies the phenotypic species concept is confined mainly or only to morphological features, while for many microfungi (e.g. yeasts) physiological or biochemical features prevail. A biological species is primarily characterized by genetic isolation from related groups of individuals. Usually genetic isolation also leads to phenotypic differentiation, so that species can be distinguished on the basis of these characters, but this is not always the case (e.g. Hallenberg, 1988). The question is whether genetic or phenotypic concepts should prevail for a decision about species level in such situations.

Although from a theoretical point of view the biological species concept seems better founded than the phenotypic species concept, it should be realized that also incompatibility patterns are not always unambiguous (Hallenberg, 1988, 1991; Petersen, 1995). Petersen (1995), in his plea in favour of a biological species concept, described the existence of partial compatibility in geographically distant isolates of the agaric *Marasmius rotula* (Scop. : Fr.) Fr. and the occurrence of morphologically inseparable, but incompatible strains of *Marasmius androsaceus* (L. : Fr.) Fr. Compatibility patterns do contribute to our understanding of speciation processes and of intraspecific variability in fungi. However, it is still a matter of debate how the results of compatibility experiments should be incorporated in the taxonomic system and formal nomenclature. Petersen (1995) did not discuss the possible taxonomic and nomenclatural implications of his data. @In *Heterobasidion annosum* (Fr.) Bref., Korhonen (1978b) distinguished in Europe ISG P and S with similar morphology, but with some degree of host specialisation (ISG P infecting mainly pine and ISG S infecting mainly spruce). Most North American strains appeared to be incompatible with either P or S strains from Europe, but among North American isolates partial compatibility was found (Chase & Ullrich, 1990). The authors suggest that *H. annosum* is undergoing speciation, which has apparently already led to genetic isolation in Europe. So far, no formal names have been proposed for the two biological species.

In some species of higher basidiomycetes a number of (partially) incompatible groups have been described without phenotypic differentiation and (therefore) not yet with formal taxonomic names, e.g. in numerous Aphyllophorales (Hallenberg, 1988, 1991), such as *Ceriporiopsis pannocincta* (Rom.) Gilb. & Ryv., *Gloeocystidiellum clavuligerum* (Höhn. & Litsch.) Nakas. and *Tubulicrinis gracillimus* (D.P. Rogers & H.S. Jackson) G.H. Cunn.

Galland (1972, 1973) reported the existence of four mutually incompatible groups within the *Psathyrella candolleana* complex (Agaricales). Following these results, Romagnesi (1975) described these groups as four species, mentioning also some minor morphological differences between the sporocarps of these taxa. However, Kits van Waveren (1985) in his monograph on *Psathyrella* concluded after thorough investigation of numerous collections that it was impossible to distinguish these on the basis of these morphological differences. Consequently, he united them again under the name *Psathyrella candolleana* (Fr. : Fr.) Maire, a solution accepted by most other mycologists.

In *Armillaria*, ISG's as determined by the compatibility test of Korhonen (1978a) do not lead to an unequivocal system, since three North American compatibility groups appear to be partially (two groups) or fully (one group) interfertile with the European compatibility group E (Anderson & al., 1980; Guillaumin & al., 1991).

The success in morphologically distinguishing ISG's A, C and D may have led to the incorrect view (including that of the present authors, cf. Termorshuizen & Arnolds, 1987; Termorshuizen, 1995; Intini, 1996) that the ISG's B and E also need to be phenotypically distinguishable. Following extended studies we conclude that ISG B and E are not sufficiently distinct morphologically. We therefore propose to recognize only those ISG's of *Armillaria* as taxonomic species that are phenotypically distinguishable. The oldest name attributed to any of the ISG's B and E is *A. lutea* Gillet (Termorshuizen & Arnolds, 1987). If the ISG of *A. lutea* is known, it can be referred to as *A. lutea* ISG B or *A. lutea* ISG E with reference to Korhonen (1978a). If these taxa are merged, as proposed here, into one species, little information is lost by the failure of their differentiation: both have the same ecology and pathogenicity (Guillaumin & al., 1985) and the determination of the ISG is of secondary importance.

CONSEQUENCES FOR THE NOMENCLATURE OF SPECIES BASED ON INTERSTERILITY GROUPS

It is possible to name species that are distinguished mainly on the basis of incompatibility tests in accordance with the rules of nomenclature (Greuter & al., 1994). The taxonomic literature has to be screened for descriptions matching the new concept as exactly as possible. Attempts were made for the European *Armillaria* species by e.g. Marxmüller (1982, 1987, 1992), Watling & al. (1982), Termorshuizen & Arnolds (1987) and Intini (1996). These studies yielded controversial results (Marxmüller, 1992). In general, two approaches have been used:

1. Names are acceptable only when they can be unequivocally matched with a taxon which has been distinguished according to genetic concepts. Following authors who claim that *Armillaria* species can be distinguished with certainty only by mating tests, this approach has resulted in new names for some ISG's of *Armillaria*. The names *A. borealis* (Marxmüller & Romagnesi, in Marxmüller (1982)) and *A. gallica* (Marxmüller & Romagnesi, in Marxmüller (1987)) were created on this basis, and quite recently the provisional names *A. europaea* and *A. varia* were proposed (Intini, 1996).
2. Names are acceptable unless they are in obvious conflict with the protologue. This is current practice in mycology, also when new phenotypic concepts, including e.g. microscopical characters, are compared with earlier descriptions (Kuyper, 1988). Otherwise it would be impos-

sible to retain many of the names introduced in the 18th and 19th century, which are based on a short diagnosis and where preserved specimens are usually lacking, including many names sanctioned by Fries (1821–32). In *Armillaria*, the names *A. cepistipes*, *A. lutea*, *A. mellea* and *A. ostoyae* are based on this approach (Termorshuizen & Arnolds, 1987). This approach is also supported by the ICBN (Greuter & al., 1994): in the case of names of doubtful application, problems can be settled by the designation of a neotype or an epitype.

TAXONOMIC STATUS OF THE EUROPEAN INCOMPATIBILITY GROUPS IN THE *ARMILLARIA MELLEA* COMPLEX

ISG A is named *Armillaria borealis* Marxm. & Korhonen, based on a holotype identified with compatibility tests. However, it would be possible that this species is identical with *Agaricus melleus* Vahl (Intini, 1996; see also ISG D). Micromorphologically, the difference between ISG A en D is unambiguous: ISG A forms clamp connections, and ISG D never does.

ISG B was first provisionally indicated by Marxmüller (1982) as *Armillaria* "*pseudobulbosa*". Romagnesi & Marxmüller (1983) concluded that this taxon was identical with *A. cepistipes* Velen., but the description of the latter deviated so much from the typical morphology of ISG B that they introduced the forma *pseudobulbosa* Romagn. & Marxm. to accommodate it. This example is illustrative of the problems in matching phenotypic and biological species concepts.

ISG C was first generally named *Armillaria obscura* (Pers.) Herink, but *Agaricus obscurus* Pers. belongs to the genus *Inocybe* (Termorshuizen & Arnolds, 1987). The name *Armillaria ostoyae* Romagnesi (1970) appeared to be a good alternative. Although the type was not checked with compatibility tests, the morphological characteristics were convincing.

ISG D is known as *Armillaria mellea* (Vahl : Fr.) Kumm., following the initial identification by Korhonen (1978a). ISG A and ISG D both occur in Denmark so that the identity of

Agaricus melleus Vahl is ambiguous. Intini (1996) identified the type plate by Vahl as ISG A and provisionally suggested to provide ISG D with a new name. However, the designation of a neotype for *Armillaria mellea* compatible with ISG D by Watling & al. (1982) has settled this problem.

ISG E was first identified as *Armillaria mellea* var. *bulbosa* Barla (= *A. bulbosa* (Barla) Kile & Watl.) (Korhonen, 1978a; Marxmüller, 1982). Later it was thought to be identical with *Armillaria lutea* Gillet, an older available name (Termorshuizen & Arnolds, 1987). These two names are based on relatively extensive descriptions, without the possibility of testing types. Marxmüller (1987) later rejected both names because of discrepancies between the descriptions and typical forms of ISG E. She introduced the new name *Armillaria gallica* Marxm.

Molecular data on nucleotide sequences of the intergenic spacers (IGS) of the nuclear rDNA show that North American isolates of *A. cepistipes* and *A. gallica* are slightly different (Anderson & Stasovski, 1992). European isolates of *A. cepistipes* and *A. gallica* have been successfully discriminated based on restriction fragment length polymorphisms (RFLP) of the IGS of the nuclear rDNA (Schulze & al., 1995). However, problems arise when isolates of the same compatibility group are compared between continents, since significant differences in RFLP of the IGS have been reported to occur between North American and European isolates of *A. gallica* (Harrington & Wingfield, 1995). To evaluate these relationships, the results have to be viewed against comparison of morphological data of fruiting bodies. Although Bérubé & Dessureault (1989) state that the morphological characters used to distinguish European *Armillaria* species can also be used to differentiate North American species, they mention that intercontinental comparisons have not been made for *A. cepistipes*. An indication that fruiting bodies of European *A. gallica* may differ morphologically from those of North American *A. gallica* is that Bérubé & Dessureault (1989) in their identification key to North American compatibility groups, mention "cap glabrous" and "annulus unpigmented" which do no apply to European *A. gallica*.

Summarizing, since Korhonen's publication (1978a), two new taxa were introduced to name the ISG's A and E, and four old names were introduced to name the ISG's B, C, D and E. The ISG's A, C and D can be reliably distinguished by morphological characters, but the ISG's B and E are morphologically similar. We propose to use the name *Armillaria lutea* (now used exclusively for ISG E) also for ISG B and to avoid the use of the younger name *Armillaria cepistipes* for this taxon, the more as the original concept deviates strongly from the typical morphology of ISG B (Termorshuizen, 1995).

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SYNOPSIS OF THE GENUS INONOTUS (BASIDIOMYCETES) SENSU LATO IN CHINA

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ABSTRACT

A new polypore, *Inonotus exilisporus* Y.C. Dai & Niemelä, collected on *Quercus* from NE China, is described and illustrated. It is characterized by resupinate basidiocarps, absence of hyphoid and hymenial setae, and by hyaline, thin-walled and narrowly ellipsoid spores. *I. levis* P. Karst. belongs to the *Inocutis* Fiasson & Niemelä group, and is commonly known by a more recent synonym, *I. pseudohispidus* Kravtzev & Schwarzman. It has a basal core in the context and thick-walled and distinctly cyanophilous spores. *I. levis* is distributed in Xinjiang of China, Kazakhstan and Turkmenistan. The differences between it and related species are discussed, and its lectotype is selected. An identification key to the species of *Inonotus* P. Karst. in China is given, and spore dimensions of each species are included according to material from China and adjacent areas of Asia. *I. leporinus* (Fr.) Gilb. & Ryvarden and *I. levis* are new to China. Some other taxa of *Inonotus* mentioned in literature from China are discussed. Chinese voucher specimens, identified as *I. dryophilus* (Berk.) Murrill, *I. hastifer* Pouzar and *I. nodulosus* (Fr.) P. Karst. were studied; they were misidentified, and these three species are not definitely known from China so far.

Key words: Basidiomycetes, China, *Inonotus*, *Inonotus exilisporus*, *Inonotus levis*, polypore, wood-rotting fungi

INTRODUCTION

Inonotus P. Karst. in China is still not well known. Many names under that genus and *Xanthochrous* Pat. were mentioned in the general Chinese mycological floras by Teng (1963, 1996) and Tai (1979). Several local fungal studies (Anonymous 1983, Bi *et al.* 1993, Li 1992, Li *et al.* 1993, Wu 1989, Zang 1980) in different parts of China have been published; the distributions of *Inonotus* species can be found in these publications, but most of them were included in *Fungi of China* (Teng 1963). Among these names, some should be allocated in other genera according to modern taxonomy, some are synonyms, and some are ill-defined. Recently Zhao and Zhang (1992) published the first polypore flora of China, and 9 species of *Inonotus* were described in the book. During a study of wood-rotting fungi in northern China, more species of *Inonotus* were found (Dai 1996, Dai & Xu 1992). One specimen was treated as *Inonotus* sp. 1 (Dai 1996), exhibiting resupinate, annual to biennial basidiocarps, a distinctly monomitic hyphal structure and thin-walled and narrowly ellipsoid spores, but lacking altogether the hymenial and hyphoid setae. These characters distinguish the material from the described species in the genus. The collection is well-developed, extensive and in a very good condition. So we describe it here as a new species. In addition, many collections from several Chinese herbaria were studied, and we give an identification key to the species of *Inonotus* found in China. Spore dimensions of each species will be included in the key according to our study from Chinese or Asian material. Some taxa in the genus mentioned from China will be discussed in the paper, too.

The genus *Inonotus* is circumscribed here in a wide sense, including *Inocutis* Fiasson & Niemelä, *Inonotopsis* Parmasto, *Inonotus* and *Onnia* P. Karst., but excluding *Cyclomyces* Fr., *Phellinidium* (Kotl.) Fiasson & Niemelä, *Phylloporia* Murrill and *Pyrrhoderma* Imazeki. Fiasson and Niemelä (1984) presented a subdivision of *Inonotus* according to the European taxa. *Cyclomyces, Onnia, Phylloporia* and *Inonotopsis* are closely related, and species in these genera mostly have annual basidiocarps, duplex context with a thin black line, and a monomitic hyphal structure. The demarcation among all these genera is unsatisfactory, and their definitions should be reworked after a systematic study on the species of these genera.

MATERIAL AND METHODS

The study bases on Y.C. Dai's personal collections from North China, on material from the most comprehensive Chinese mycological herbarium HMAS (Beijing, China), and on collections from HBNNU (Changchun, NE China) and HKAS (Kunming, South China). Some specimens collected from China by French Emil Licent during 1914–1936, mostly deposited in PRM (Prague, Czech Republic), were studied, too. Furthermore, more material from H (Helsinki, Finland), TAA (Tartu, Estonia) and TFM (Tsukuba, Japan) was studied to support our results.

The measurements and drawings were made from slide preparations stained with Cotton Blue (CB). Spores were measured from sections cut from the tubes. IKI stands for Melzer's reagent and KOH for 5% potassium hydroxide; CB+ means cyanophilous and CB– acyanophilous. In presenting the variation in the size of the spores (pores, hyphae, basidia), 5% of the measurements were excluded from each end of the range, and are given in parentheses. In the text the following abbreviations are used: L= mean spore length (arithmetical mean of all spores, in µm), W= mean spore width (arithmetical mean of all spores, in µm), Q= quotient of the mean spore length and the mean spore width (L/W ratio), (n=x/y) x measurements of spores (pores, hyphae, basidia) from y specimens. The width of a basidium was measured at the thickest part, the length of a basidium was measured from the apex (sterigmata excluded) to the basal septum. Sections were studied at magnification up to x1250 by using a Leitz Diaplan microscope and phase contrast illumination. Drawings were made with the aid of a drawing tube.

DESCRIPTION

Inonotus exilisporus Y.C. Dai & Niemelä, *spec. nova* (Fig. 1)
Carpophorum annuum vel bienne, resupinatum; pori 4–5 per mm. Systema hypharum monomiticum, hyphae septatae, setae nullae; sporae hyalinae, anguste-ellipsoideae, 6.1–7.3 × 2.8–3.5 µm.

Type: China. Liaoning Prov., Kuandian County, Guanshui, broadleaf forest, on fallen trunk of *Quercus mongolica*, 25.IX.1995 *Dai 2172* (H, holotype, isotypes in HMAS, NMNS, O).

Etymology — *Exilis* (Lat., adj.): thin, slender; *-sporus* (Lat.): -spored.

Basidiocarps annual or biennial, resupinate, adnate, inseparable, usually making up an ellipsoid patch, ca. 20 cm or more in the longest dimension, up to 5 cm wide, corky when fresh, woody hard upon drying, without odour or taste. Margin thin and narrow, tomentose, rust brown. Pore surface greyish brown; pores angular, 4–5(–6) per mm (n=30/1), tube mouths mostly entire, sometimes slightly lacerate. Subiculum dark brown, very thin (not exceeding 1 mm), corky. Tubes greyish brown to dark brown, corky or almost woody, up to 3 mm long.

Hyphal system monomitic; all septa without clamp connections; tissues darkening but otherwise unchanged in KOH.

Subiculum. — Generative hyphae varying from hyaline and thin-walled to yellowish and fairly thick-walled, strongly interwoven, frequently septate and branched, (3–)4–7(–8) µm in diam (n=30/1). No hyphoid setae.

Tubes. — Tramal hyphae varying from hyaline and thin-walled at dissepiment edges to yellowish and slightly thick-walled toward inner trama, occasionally branched, parallel, (2.8–)3–4(–4.2) µm in diam (n=30/1). No hyphoid or hymenial setae; big bipyramidal crystals abundant. Subhymenium distinct; basidia clavate, with four sterigmata and a simple basal septum, (13–)14–17(–20) × (4–)4.5–6(–7) µm (n=30/1); basidioles barrel-shaped to clavate, smaller than basidia. Hyphal pegs present.

Spores. — Basidiospores narrowly ellipsoid, thin-walled, hyaline, smooth, bearing one or two small guttules, IKI–, CB–, (6–)6.1–7.3(–8) × (2.5–)2.8–3.5(–3.6) µm, L=6.67, W=3.09, Q=2.16 (n=30/1).

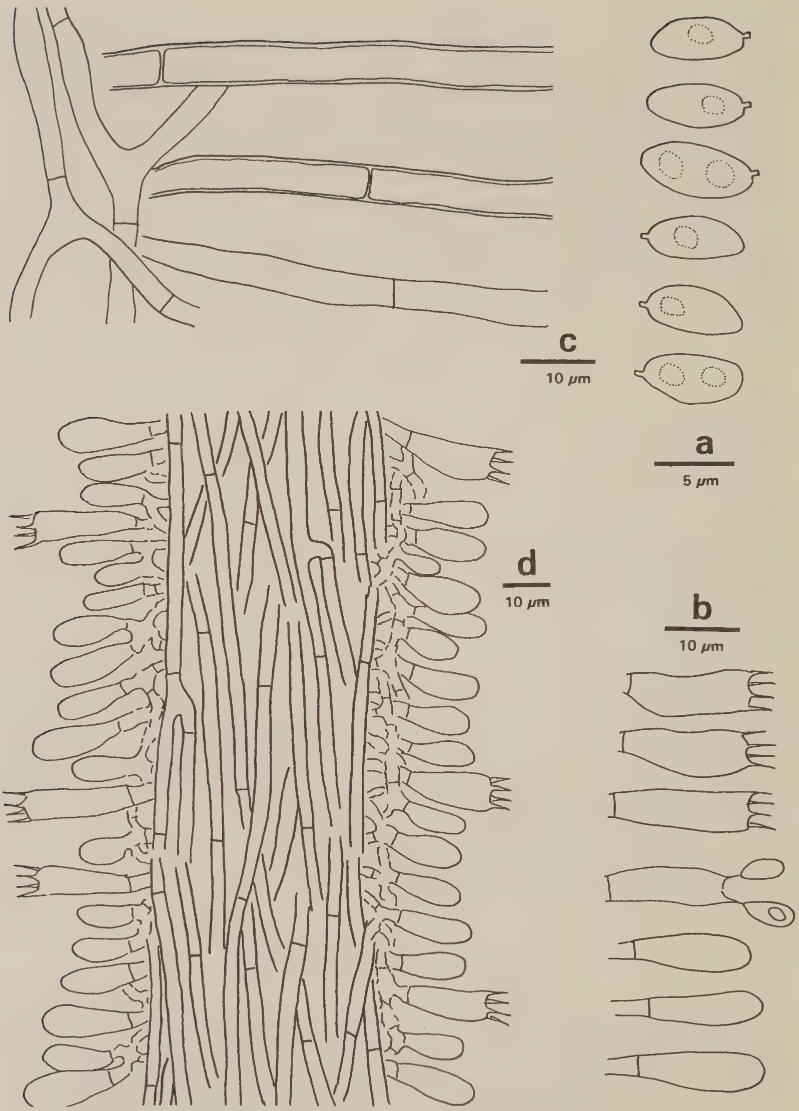

Fig. 1. Microscopic structures of *Inonotus exilisporus* Y.C. Dai & Niemelä (drawn from holotype). —a) spores, —b) basidia and basidioles, —c) subiculum hyphae, —d) a vertical section through trama.

Inonotus exilisporus is characterized by resupinate basidiocarps, thin-walled, hyaline and narrowly ellipsoid spores, and by the lack of hyphoid and hymenial setae. These characters make it differ from the other species of the genus. *I. flavidus* (Berk.) Ryvarden is the only species in the genus which has thin-walled, hyaline and cylindric-ellipsoid spores. However, it has distinctly pileate basidiocarps, duplex context with a black line, and scattered hymenial setae; its spores are smaller than those in the new species (5–6 × 2–2.2 µm vs. 6.1–7.3 × 2.8–3.5 µm). For *I. flavidus*, the following specimen was studied: Japan. Fukushima, 21.XI.1986 *Abe* (H, ex TFM).

In the genus *Phellinus* Quél. only *P. andinopatagonicus* (J.E. Wright & J.R. Deschamps) Ryvarden and *P. discipes* (Berk.) Ryvarden have thin-walled, cylindric or cylindric-ellipsoid spores, and lack hyphoid and hymenial setae. The former has distinctly perennial and pileate basidiocarps, a trimitic hyphal structure, large spores (8.2–10.8 × 2.8–3.2 µm), and it is distributed in South America only (Larsen & Cobb-Poulle 1990). The latter species has very similar spores as in the new species, but it has pileate to substipitate basidiocarps, smaller pores (6–7 per mm), barrel-shaped basidia and cystidia, and it is distributed in tropics (Larsen & Cobb-Poulle 1990, Zhao & Zhang 1992). For *P. discipes*, the following specimen was studied: Indonesia. Sumatra, 28.VI.1925 *Yates 1650* (H).

KEY TO THE SPECIES OF INONOTUS SENSU LATO IN CHINA

1. Basidiocarp distinctly pileate.. 6
1. Basidiocarp resupinate to effused-reflexed 2
2. Basidiocarp soft when fresh and cottony coriaceous when dry, setae absent; on gymnosperm....................................***I. subiculosus*** (Peck) J. Erikss. & Å. Strid
(5.9–)6.1–7.5(–8) × (3.9–)4–5.1(–5.5) µm, L=6.59, W=4.58, Q=1.44 (n=30/1)
2. Basidiocarp corky to woody hard or brittle when dry, setae present or absent; on angiosperm 3
3. Hymenial and hyphoid setae absent, spores narrowly ellipsoid.......................... ....***I. exilisporus*** Y. C. Dai & Niemelä
(6–)6.1–7.3(–8) × (2.5–)2.8–3.5(–3.6) µm, L=6.67, W=3.09, Q=2.16 (n=30/1)
3. Hymenial or hyphoid setae present, spores broadly ellipsoid or ovoid 4
4. Hymenial setae absent, hyphoid setae present in trama; on *Salix*........................ ....***I. pruinosus*** Bondartsev
(5.8–)6–7.4(–8) × (4.1–)4.5–6(–6.3) µm, L=6.68, W=5.08, Q=1.24–1.4 (n=90/3)
4. Hymenial setae present, hyphoid setae absent; not on *Salix*.............................. 5
5. Basidiospores thick-walled and yellow ...***I. andersonii*** (Ellis & Everhart) Černý
(5.5–)5.9–7.1(–7.2) × (4.2–)4.7–5.2(–5.4) µm, L=6.52, W=4.99, Q=1.31 (n=30/1)
5. Basidiospores thin-walled and hyaline.................... ***I. obliquus*** (Pers.: Fr.) Pilát
(7.9–)8–9.7(–9.8) × (4.9–)5–5.7(–6) µm, L=8.67, W=5.14, Q=1.69 (n=30/1)
6. Context lacking a core; setae present or absent 9
6. Context bearing a granular core; setae absent 7

7. Basidiospores mostly less than 6.5 µm long, fairly thick-walled........................ ....**I. rheades** (Pers.) P. Karst.
(5–)5.3–6.5(–7) × (3.5–)3.8–4.7(–5) µm, L=5.94, W=4.13, Q=1.43–1.45 (n=58/2)
7. Basidiospores mostly over 6.5 µm long, distinctly thick-walled 8
8. Basidiospores CB– or very weakly CB+ in juvenile stage, hyphae at dissepiment edge less than 5 µm wide, on *Tamarix*..........................**I. tamaricis** (Pat.) Maire
(6–)6.5–7.8(–8) × (4.5–)4.8–5.8(–6) µm, L=7.15, W=5.16, Q=1.34–1.42 (n=90/3)
8. Basidiospores distinctly CB+, hyphae at dissepiment edge over 5 µm wide; not on *Tamarix* ....**I. levis** P. Karst.
(7–)7.3–9.2(–10) × (4.7–)5–6(–6.5) µm, L=8.17, W=5.52, Q=1.44–1.51 (n=90/3)
9. Basidiospores distinctly yellowish to reddish brown 13
9. Basidiospores hyaline.. 10
10. Basidiospores thick-walled, subglobose, dextrinoid and CB+............................. ....**I. dryadeus** (Pers.:Fr.) Murrill
(6.5–)7–8.5(–9) × (5.5–)6–8(–8.2) µm, L=7.8, W=7.2, Q=1.08 (n=30/1)
10. Basidiospores thin-walled, ellipsoid, IKI– and CB–.. 11
11. Setae straight; terrestrial, arising from roots ....**I. tomentosus** (Fr.) Teng
(4.5–)5–6.3(–6.5) × (2.8–)3–3.8(–4) µm, L=5.59, W=3.25, Q=1.72 (n=34/1)
11. Setae hooked, terrestrial or on trunks or stumps.. 12
12. Basidiocarps applanate, more or less brittle when dry, tubes usually 5–10 mm long, context less than 1.5 cm thick; tramal hyphae non-gelatinized.................... .... **I. leporinus** (Fr.) Gilb. & Ryvarden
(6–)6.2–7(–7.5) × (3.3–)3.4–4.2(–4.4) µm, L=6.52, W=3.79, Q=1.72 (n=35/1)
12. Basidiocarps triquetrous, hard when dry, tubes usually less than 5 mm long, context up to 4 cm thick; tramal hyphae agglutinated .... **I. triqueter** (Lenz) P. Karst.
(5–)5.4–7(–8) × (3–)3.1–4.8(–5) µm, L=6.03, W=3.83, Q=1.57 (n=30/1)
13. Hymenial setae present................................**I. radiatus** (Sowerby: Fr.) P. Karst.
(3.5–)4–5(–5.2) × (2.2–)2.8–3.5(–3.8) µm, L=4.36, W=3.02, Q=1.4–1.51 (n=88/3)
13. Hymenial setae absent.. 14
14. Branched hyphoid setae present in tomentum ...**I. cuticularis** (Bull.:Fr.) P. Karst.
(6–)6.1–7.3(–8) × (4.4–)4.8–5.5(–6) µm, L=6.83, W=5.08, Q=1.34 (n=30/1)
14. Branched hyphoid setae absent........................... **I. hispidus** (Bull.:Fr.) P. Karst.
(8–)8.5–10(–11) × (7–)7.5–8.8(–9) µm, L=9.63, W=7.73, Q=1.25 (n=30/1)

NOTES ON SOME SPECIES

Inonotus dryadeus

The species occurs in South China. One specimen collected on *Abies* from Xizang (Tibet) has been carefully studied. Its context is dominated by sclerified generative hyphae, which are very thick-walled, dark brown, straight and occasionally simple-septate. This structure is very different from both the Chinese specimens collected from angiosperms, and the European material on *Quercus*. Spores in the Chinese specimen on *Abies* are basically ovoid, slightly differing from the subglobose spores in Europe. *I. dryadeus* was reported to live mainly on *Abies* in the Pacific Coast Region of the USA (Gilbertson & Ryvarden 1986), and we have not studied any collection on *Abies* from North America. Because we have only a single specimen, we keep it for the time being in *I. dryadeus*.

Inonotus levis

Inonotus levis P. Karst., Hedwigia 26:112. 1887. Lectotype: "*Inonotus levis* Karst." [Turkmenistan, Ashgabat ('Askabad'), *Salix*, Walther] (herb. *Karsten 3988*, H, studied). — *I. pseudohispidus* Kravtzev & Schwarzman, Bull. Acad. Sci. Kazak S.S.R., Ser. Biol. 5:128. 1950.

During a study of the Chinese material of *Inonotus*, we came across two collections from semidesert area of Xinjiang Auto. Reg., Northwest China. These specimens were reported as *I. rheades* by Zhao and Zhang (1992). After carefully studying them in the microscope, we found that they have big, thick-walled and distinctly cyanophilous spores. The Chinese collections fit with the description of *I. pseudohispidus*, but differ from other species of the *Inocutis* group *(Inonotus dryophilus, I. rheades, I. tamaricis* and *I. texanus* Murrill). After a closer study, we found that there is an older name for *I. pseudohispidus*: *I. levis*, whose good-quality type is in Helsinki (herb. H). This species was originally described on material from Turkmenistan by Karsten (1887), and although it has been cited several times (Saccardo 1888:129, Lowe 1956, Pegler 1964), the name has remained almost forgotten. The type locality has a flora similar to that in Xinjiang of China, and the Chinese specimens fit completely with the type. In Karsten´s original publication (Karsten 1887) two localities were mentioned, 'Askabad'=Ashgabat and 'Jermib'=Germob. When Saccardo (1888:129) republished this species as *Polyporus levis* (P. Karst.) Sacc., only Askabad was mentioned and that is presumably the locality of Karsten´s sole specimen in H, although he did not indicate it. Lowe (1956) selected the specimen as "type". Saccardo´s combination *Polyporus levis* is illegitimate, because it is a later homonym of *Polyporus levis* Pers. (Persoon 1825:68), another species.

The species was reported as *Inonotus pseudohispidus* from several localities in Kazakhstan by Kravtzev (1950) and Shvartsman (1964), and was mentioned by Bondartseva and Parmasto (1986). We did not study its type, but the description (see also Pegler 1964) fits well with *I. levis*, and its distribution is close to Turkmenistan and Xinjiang of China. For these reasons we are convinced that *I. pseudohispidus* is a synonym of *I. levis*.

Inonotus levis has ungulate basidiocarps; its pores are 2–3 per mm (n=60/3); the basal core is distinct, but it occupies a minor part of the context (on the contrary, the core occupies major part of the context in *I. dryophilus*); no gloeoplerous hyphae are present at dissepiment edge, while *I. dryophilus* and *I. texanus* have gloeoplerous hyphae there. The key character of this species is that its spores are distinctly cyanophilous: mature spores are CB–, or only juvenile spores are weakly CB+ in the other species of the *Inocutis* group.

Inonotus levis is closer to *I. tamaricis,* and the latter occurs in Central Asia as well. Microscopically the hyphae at dissepiment edge are much wider in the former species than in the latter (4.6–7 µm diam, n=40/2 vs. 3–4.3 µm diam, n=40/2). In addition, *I. levis* grows on *Salix*, *Populus, Acer* and *Fraxinus* (Pegler 1964, Shvartsman 1964), while *I. tamaricis* grows exclusively on *Tamarix*.

Inonotus obliquus

The black "sterile conk" produced by *Inonotus obliquus* was found in the Changbai Mts. of NE China, but no basidiocarps of the species have been collected from the country. *I. obliquus* was reported from the Russian Far East (Lyubarsky & Vasilyeva 1975), too, and a good specimen collected from Primorye Terr. in TAA was studied. The spore dimensions of the species in the key above come from that collection.

Inonotus pruinosus

The species has been found from northeastern China only. It is characterized by extensive pruinose basidiocarps, thick-walled and golden yellow spores, by the lack of hymenial setae and the presence of hyphoid setae instead, and by the growth exclusively on *Salix*. An illustrated description and a photograph *in situ* were published by Dai *et al.* (1996).

Inonotus subiculosus

This species was found in the virgin forest of the Changbaishan Forest Reserve in NE China. It develops extensive basidiocarps on rotten wood of *Abies*. It lives in a moist place, and sometimes produces strong rhizomorphs. Its ecology is very similar to that of *Asterodon ferruginosus* (Fr.) Pat. which, however, is hydnoid and has branched setae and distinctly cyanophilous spores. *I. subiculosus* has prominently duplex subiculum and thin-walled, ellipsoid spores which are mostly glued together in tetrads. *Onnia* (comprising the species which are in this paper treated *as Inonotus leporinus, I. tomentosus* and *I. triqueter*) shares these characters with *I. subiculosus*, but species of that genus have pileate to stipitate basidiocarps and robust setae. A colour picture by Dai from Changbai Mts. of the species was published by Kotiranta and Niemelä (1996).

EXCLUDED AND DOUBTFUL NAMES

Inonotus dryophilus was reported from China by Pilát (1940) as *I. corruscans* (Fr.) P. Karst. Its specimen (PRM 883870) was studied, and we confirm that it is actually *I. rheades*.

Inonotus flavidus (Berk.) Ryvarden was mentioned from China by Tai (1979) as *I. sciurinus* Imazeki. We did not find any specimens from China, and its distribution in the country remains uncertain.

One collection from East China was reported as ***Inonotus hastifer*** Pouzar by Hattori and Zang (1995). Hattori (pers. comm. 1996) mentioned that the specimen is in fact not *I. hastifer*. We have studied the material, and it has a dimitic hyphal structure, and lacks hyphoid setae in the trama. So it belongs to *Phellinus*. The material is sterile, and we are reluctant to identify it.

Inonotus nodulosus (Fr.) P. Karst. was reported by Zhao and Zhang (1992). We have studied all the specimens cited under the species, and to us they are *I. radiatus*.

Teng (1963) reported that ***Inonotus orientalis*** (Lloyd) Teng and ***I. substygius*** (Berk. & Broome) Teng occur in China. According to our study on these collections in HMAS, a specimen named as *I. orientalis* by Teng (HMAS 22719) is actually *Coltricia vallata* (Berk.) Ryvarden, and the material with the name *I. substygius* (HMAS 42380, 60564, 61159) has small pores (9-10 per mm), a dimitic hyphal structure, ventricose hymenial setae, and thin-walled, ellipsoid spores, and so it belongs to the genus *Phellinus*.

Inonotus radiatus var. ***licentii*** Pilát was described from northern China (Pilát 1940). The type (PRM 629546) was studied: it has homogeneous context and a dimitic hyphal structure; its setae arise from subhymenium, (20–)22–32(–33) × 4–6 µm (n=30/1); only three spores were found, and they are ellipsoid and thin-walled, 4 × 3–3.1 µm. Therefore, it does not belong to *Inonotus* at all, but is *Phellinus gilvus* (Schwein.) Pat.

SPECIMENS STUDIED

Inonotus andersonii. **China**. Inner Mongolia, *Quercus*, IX.1917 *Licent 567b, 730, 740* (type material of *I. krawtzewii* Pilát, PRM 807113, 807111, 807112). **Russia**. Primorye, *Populus*, 12.IX.1975 *Parmasto* (TAA 59795); *Quercus*, 29.VIII.1975 *Parmasto* (TAA 59513). **U.S.A.** Tennessee, *Quercus*, 1956 *Lowe 20789* (H). Ohio, ?*Populus*, 1895 *Lloyd* (H). — ***I. cuticularis***. **China**. Hunan, *Zhou 25* (HMAS 24603). **Canada**. Quebec, *Acer*, 2.XI.1991 *Ginns 9711* (DAOM 21347). — ***I. dryadeus***. **China**. Guangxi, XII.1951 *He* (HMAS 17488). Xizang (Tibet), *Abies*, 13.IX.1976 *Zang 895* (HKAS 5895). **Sweden**. Öland, *Quercus*, 16.VIII.1975 *Jeppson 1051* (H). **England**. Kent, 24.VII.1945 *Wiltshire* (H). **Germany**. Nord-Hessen, *Quercus*, 7.IX.1979 *Niemelä 1700* (H). — ***I. hispidus***. **China**. Beijing, *Sophora*, 10.VIII.1993 *Dai 1324* (H). Jilin, *Fraxinus*, 18.X.1993 *Dai 1679* (H). **Sweden**. Gotland, *Sorbus*, 1.IX.1974 *Nordin 5798* (H). — ***I. leporinus***. **China**. Jilin, IX.1958 *Jin* (HMAS 23799), VIII.1984 *Zeng* (HBNNU). **Finland**. Satakunta, *Picea*, 6.X.1968 *Niemelä* (H). — ***I. levis***. **China**. Xinjiang, angiosperm, 15.IX.1958 *Xu 343* (HMAS 25958); VII.1980 *Zhao* (HMAS 42774). **Turkmenistan** (see the lectotype). — ***I. obliquus***. **Russia**. Primorye, *Betula*, *Parmasto* (TAA). **Finland**. Etelä-Häme, *Betula*, 16.IX.1996 *Dai 2284 & Niemelä* (H). — ***I. pruinosus***. **China**. Liaoning, *Salix*, 30.VIII.1954 *Gorlenko* (LE *22479*, holotype), 5.IX.1995 *Dai 1972b* (H, LE, O), 23.IX.1995 *Dai 2162* (H). — ***I. radiatus***. **China**. Jilin, *Acer*, 21.VII.1993 *Dai 641* (H); *Betula*, 16.VII.1993 *Dai 530* (H), 5.VIII.1960 *Yuang 593* (HMAS 29925). Heilongjiang, angiosperm, *Teng 6726* (HMAS 33730). **Finland**. Uusimaa, *Corylus*, 1.XI.1996 *Dai 2307* (H). Etelä-Häme, *Alnus*, 8.X.1992 *Dai 207*

& Niemelä (H). — ***I. rheades***. **China**. Beijing, *Populus*, 2.XI.1993 *Dai 1840* (H). Shanxi, 3.VIII.1933 *Licent 3200* (PRM 883870). **Finland**. Etelä-Häme, *Populus*, 17.IX.1996 *Dai 2290 & Niemelä* (H). — ***I. subiculosus***. **China**. Jilin, *Abies*, 14.IX.1995 *Dai 2103* (H). **Canada**. British Columbia, *Pseudotsuga*, 3.IX.1946 *Salisbury V-4233* (H). **Finland**. Perä-Pohjanmaa, *Picea*, 18.IX.1962 *Strid & Eriksson 10492* (H, ex GB 6136). — ***I. tamaricis***. **China**. Beijing, *Tamarix*, 5.VII.1993 *Dai 318* (H), 15.VIII.1993 *Dai 886* (H). **Greece**. Crete, *Tamarix*, 1977 *Niemelä* (H). Rhodes, *Tamarix*, 4.VI.1975 *Ahti 30120* (H). — ***I. tomentosus***. **China**. Jilin, *Picea*, 12-16.IX.1983 *Ryvarden 21501* (HMAS 48069, O), ground next to *Larix*, 15.IX.1995 *Dai 2161* (H); VIII.1974 *Li* (H). **Finland**. Uusimaa, ground close to *Pinus*, 4.X.1975 *Niemelä 531* (H), 1.IX.1974 *Väisälä* (H). — ***I. triqueter***. **China**. Jilin, *Abies*, 12-16.IX.1983 *Ryvarden* (HMAS 48108, O). **Czech Republic**. Moravia, *Pinus*, 12.VII.1967 *Černý* (H).

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CANTHARELLUS FORMOSUS AND THE PACIFIC GOLDEN CHANTERELLE HARVEST IN WESTERN NORTH AMERICA

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ABSTRACT - The correct name for the most commonly harvested chanterelle in western North America (western BC, WA, and OR, and northwestern CA) is *C. formosus* and not *C. cibarius*. The type locality for *Cantharellus formosus* is Long Beach, Pacific Rim National Park, Vancouver Island, British Columbia, Canada, and not Barkley Sound. Fresh topotypical material was gathered for morphological and molecular characterization. A less commonly harvested western chanterelle is *Cantharellus cibarius* var. *roseocanus* var. nov.

KEY WORDS: RFLP, Pfifferling, Pacific Golden Chanterelle, Rainbow Chanterelle, FEMAT, rare, export, PNW, USA.

INTRODUCTION

Cantharellus formosus Corner (1966), first described from Vancouver Island, British Columbia, has been listed either as a rare, old-growth forest endemic (and therefore endangered) species or as a common, commercially harvested species (Redhead et al. 1996). Its taxonomic identity, type habitat, and subsequent monetary importance in Canada and the U.S.A. are the subjects of this and a second paper (Danell et al. in preparation[1]).

Economic value of western chanterelles

Because chanterelles have not been successfully cultivated until recently (see Danell & Camacho 1997), all fruitbodies have necessarily been collected from nature. Economically, golden chanterelles (also known as yellow chanterelles) are one of the top three commercially harvested and exported edible wild mushroom crops in western North America. In Washington (Fig. 1), Oregon and Idaho over $3.6 million US were paid to chanterelle harvesters in 1992 (Schlosser & Blatner 1995a, b), with a final value worth many more millions to retailers. Chanterelles are second only to morels in amounts collected the western United States (Rowe 1997). In British Columbia (Figs. 2, 3) chanterelles are considered among the top three mushrooms along with pine mushrooms [*Tricholoma magnivelare* (Peck) Redhead] and morels [*Morchella* spp.] (de Geus et al. 1992; de Geus 1995; Redhead 1997). The western chanterelle harvest has typically been divided between what is called the golden or yellow chanterelle and the white chanterelle (*Cantharellus subalbidus* Smith & Morse). The latter, a whitish species as indicated by its names, brings a lower market value in Europe due to the preference for the traditional yellow European species, *Cantharellus cibarius* Fr.: Fr. (de Geus et al. 1992; Redhead 1992). In western North America golden chanterelles commercially harvested from Alaska and the Queen Charlotte Islands, B.C. southward to California have long been regarded as *Cantharellus cibarius* (e.g. Anonymous 1995; Arora 1986; de Geus 1995; de Geus et al. 1992; Molina et al. 1993; Rowe 1997; Schlosser & Blatner 1994, 1995; Smith & Morse 1947).

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[1] Danell, E., F.J. Camacho, A. Liston, S.A. Redhead and L.L. Norvell. (in preparation). RFLP and sequencing of rDNA ITS of the ectomycorrhizal edible mushrooms *Cantharellus cibarius, C. pallens, C. formosus* and *C. subalbidus.*

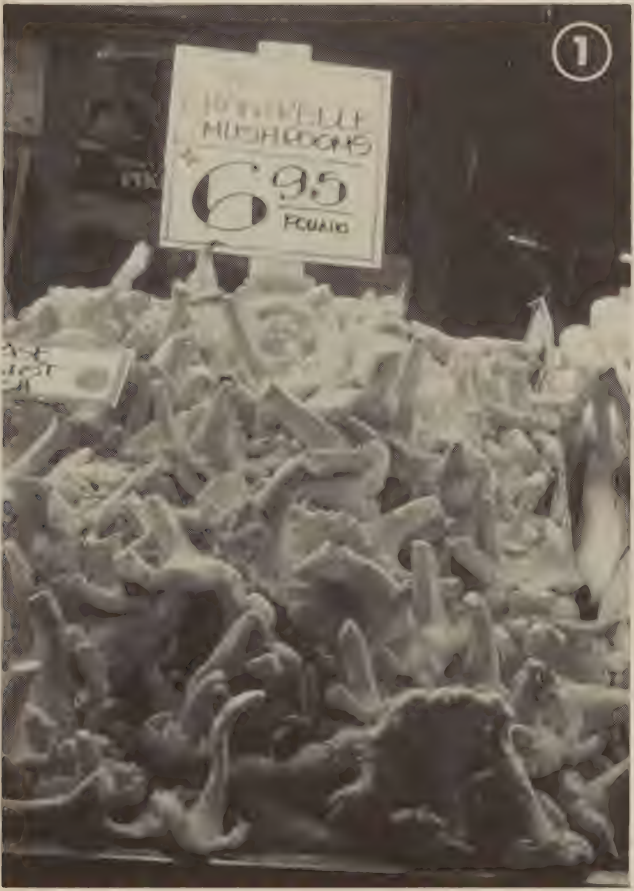
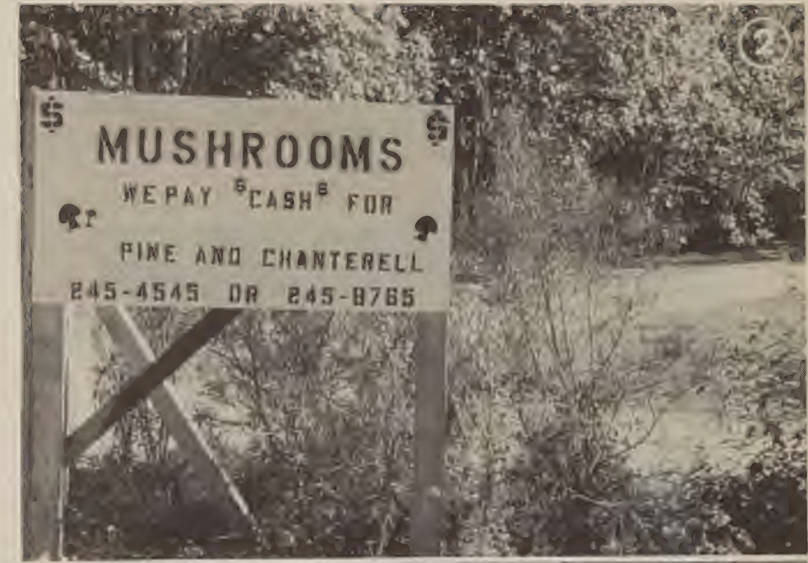


Fig. 1. Fresh local chanterelles (*Cantharellus formosus*) for sale (US dollars) at Pike's Street Market, Seattle, WA, in 1993.



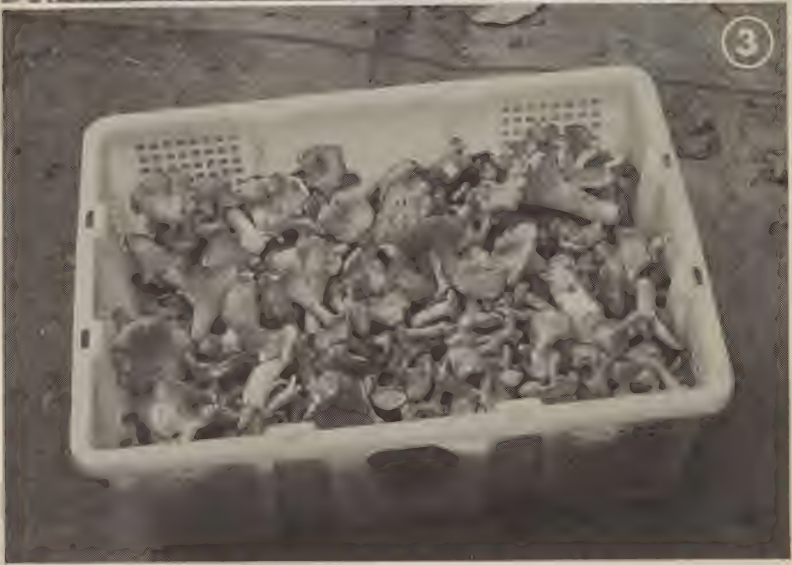


Fig. 2. Mushroom buyer's roadside sign on Vancouver Island, BC. Fig. 3. *Cantharellus formosus* in holding bins at the same buying station.

Conservation activities and chanterelles

Counterbalancing financial rewards from large scale harvesting of chanterelles and other native mushroom species are concerns over crop sustainability (i.e. harvesting effects) and preservation of habitat and rare or threatened species. In Europe, one on-going study on edible mushrooms (including *Cantharellus tubaeformis* Fr.:Fr.) was begun in 1975 (Egli et al., 1990). In North America an intensive on-going study of western chanterelle sustainability and harvesting effects was initiated in Oregon in 1986 by the Oregon Mycological Society (Norvell 1988, 1991, 1992a, b, 1995b; Norvell et al. 1995a,b). Western chanterelle phenology and biology is the subject of a more recent study in northern California (Largent & Sime 1995). Additionally the legal ramifications resulting from treatment of certain chanterelles in the US government's **Report of the Forest Ecosystem Management Assessment Team** [USDA/DI 1993] as possibly endangered have produced a more immediate social impact. *Cantharellus formosus* has been listed as a **Strategy - 1** fungus [USDA/DI 1993, 1994a] in the United States. In the **Record of Decision** and **Standards and Guidelines** [USDA/DI 1994b], a "**Strategy - 1**" listing requires land users to "manage known sites." Therefore, known *Cantharellus formosus* sites must be "managed" in accordance with the law. Interestingly the **Appendix J2** of the **Final Supplemental Environmental Impact Statement** [USDA/DI 1994a, **Appendix J2** pgs. 159-160] noted the controversy over the identity of the "common" chanterelle in the Pacific Northwest [and British Columbia] which may not be "...*Cantharellus cibarius*, but could be more related to or the same as *C. formosus*" and recommended the issue be resolved by additional studies.

Historical views on western North American chanterelles

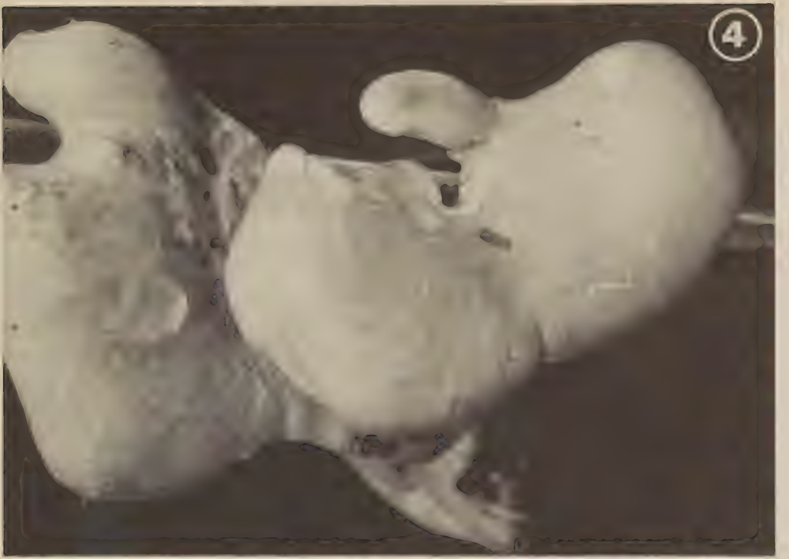
Controversy regarding the identity of western golden chanterelles started with Murrill's (1912) statement: "I found it difficult to believe that this was the same plant I had seen so often in Europe and the eastern United States." Smith & Morse (1947) later similarly observed, "...one who knows the fungus from our eastern states or from the illustrations in the European literature might easily fail to recognize it here."

In fact in 1938 the English botanist Prof. E.J.H. Corner, who knew *C. cibarius* from Europe, immediately recognized the distinctiveness of one western species and, after storing a collection in liquid for 28 years, eventually named it *Cantharellus formosus* Corner (1966). Shortly after publication, Petersen (1969) stated, "...although *C. cibarius* (both forms) occurs uncommonly in the far western United States, the prevalent species which is usually called *C. cibarius* is really *C. formosus.....*" Subsequently, Thiers (1985) recognized both *C. cibarius* and *C. formosus* from California, with the latter occurring under conifers in the northwestern corner of the state which shares a vegetation zone in common with the Pacific Northwest, USA and British Columbia, Canada. Tylutki (1987) recognized and described *C. formosus* from low elevations on the Olympic Peninsula in Washington State, noting that it, like *C. cibarius*, was being harvested and exported to Europe as an edible. However, both before and after Corner's publication the common western chanterelle has been repeatedly referred to as *Cantharellus cibarius* (Bandoni & Szczawinski 1976; Lincoff 1982; McKnight & McKnight 1987; Miller 1978; Orr & Orr 1979, Phillips 1991; Schalkwijk-Barendsen 1991; Smith 1949, 1975; Smith & Morse 1947; Smith & Smith 1973; Smith & Weber 1980).

Even where *C. formosus* is mentioned (e.g. Arora 1986) mixed species concepts have continued to be published as a result of the overlapping characters found in *C. formosus* and *C. cibarius*. The large orange form of "*Cantharellus cibarius*" shown in Arora's fig. 178, may be a better candidate for *C. formosus* (see below). In the face of so much confusion, Norvell (1994) adopted a cautious stance when she wrote, "It is possible that the Pacific Northwest chanterelle may be a different species (the name for this species would be *C. formosus*)...."; this tentative identification was again emphasized in a later article on chanterelle harvesting (Norvell 1995a).

Additional evidence supporting the existence of distinct entities in the "*C. cibarius*" complex in the west emerged when Feibelman et al. (1994) demonstrated that the internal transcribed spacer (ITS) between the 18S and 28S genes of the nuclear ribosomal DNA showed significant length variation (i.e. up to 290 bp differences) between eastern North American, European, and certain western North American collections. A more detailed study of western collections using restriction enzymes on the same amplified ITS region (Danell 1995) revealed a consistent difference between the "PNW *C. cibarius*" and both the typically Swedish *C. cibarius* and *C. subalbidus*. This study was performed after Danell observed morphological differences from European *C. cibarius* and was unable to cultivate the PNW *C. "cibarius*" using techniques developed for Swedish *C. cibarius* (Danell 1994a,b). A further complicating factor also confirmed by Danell (1995) was the existence of a separate yellow species known from at least the coastal fringe under sitka spruce (*Picea sitchensis* (Bong.) Carr.) in Oregon.

Part I - Cantharellus formosus



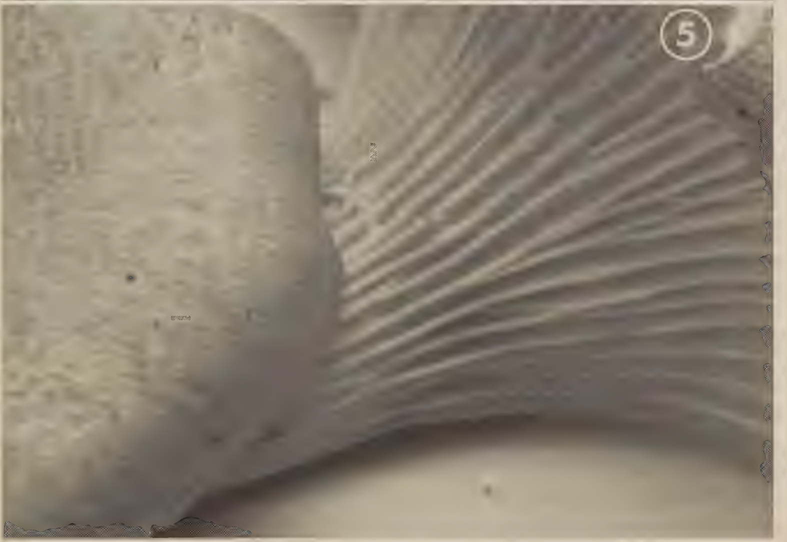


Fig. 4. Appressed darkened scales on pilei of *C. formosus* from Kildonan, BC (DAOM 220707), ca 1.5 x mag. Fig. 5. As above, from Mt. Hood, OR, chanterelle study plot (LLN 94.10.17-1), ca 3 x mag.

Dry weather hypothesis

While stationed at the University of Washington in 1993-1994, Redhead, along with Norvell (a designer and coordinator of the Oregon Mycological Society's chanterelle harvest study) and Joe Ammirati (a contributing author to the FEMAT report) discussed the probable identity of *Cantharellus formosus* as first described by Corner. In his 1966 monograph, Corner placed *C. formosus* in his group **"C"**, series **"2"** of his key to *Cantharellus* subgenus *Cantharellus* sect. *Cantharellus*. It was therefore well separated from *C. cibarius* var. *cibarius* with smooth pilei in his group **"B"**, series **"1"**, apparently by the subtomentose to subfloccose pileus which he described and illustrated. As most collections of western chanterelles lack such features when collected, they have naturally been keyed to *C. cibarius*. Pertinent to the question of identifiable characteristic taxonomic features were data collected over 10 years from the western US research sites – the Oregon Chanterelle Study Project (OCSP) plots (Norvell 1992a) and later from northwestern coastal California plots (Largent & Sime 1995) - which indicated that the average lifespan for fruitbodies of western golden chanterelles exceeded 40 days while some lasted over 100 days. Phenetic plasticity was noted to result from growth over long periods under changing weather patterns and conditions. Based on our observations on chanterelle growth forms in northwestern Washington and from the Oregon (OCSP) plots, a hypothesis emerged that the type description for *C. formosus* described a growth form which developed during some types of dry weather conditions (Norvell 1995a). In both Oregon and Washington the presence of matted floccose patches on the pileus -- well enough developed in some cases to qualify as scales (Figs. 4, 5) -- and pinkish hues on the hymenium (both key features emphasized by Corner, 1966 p. 32, 36) were noted to be more conspicuous on basidiomes collected in dry weather and virtually absent on specimens collected during prolonged wet periods.

It became obvious that a return to the type locality at about the same time of year as originally collected was necessary in order to resolve whether or not the correct name for the common, commercially harvested species was *Cantharellus formosus*, particularly as Danell required fresh material for comparison with the general PNW population. DNA from the holotype was expected to have degraded by the formalin and alcohol in which it was preserved (Corner, 1966). Thus in April, 1994 correspondence was initiated with Dr. Corner regarding the precise type locality and habitat.

Conflicting habitat and type locality data

Published data for the type collection reads, "In conifereto gregarious; Canada, Vancouver Isl. (Barkley Sound, Uckeluelhet; leg. E.J.H. Corner, 3 Sept. 1938." Unfortunately, the specific location, "Uckeluelhet", cited by Corner (1966) is not listed in historical or current Canadian gazetteers (Anonymous 1930, 1939, 1985). Furthermore, there are two locations with somewhat similar spellings in the vicinity of Barkley Sound, namely "Ucluelet" (N48°56'00" W125° 33'00"), on the Ucluth Peninsula at the extreme northwestern mouth of the sound, and "Uchucklesit Inlet" (N49°00' W125°00') at the head of the sound where it joins Alberni Inlet (Figs. 6, 7). Discussions with local residents gave equally divided opinions as to whether or not "Uckeluelhet" referred to Ucluelet or Uchucklesit. One anonymous local First Nations resident stated "Uckeluelhet" was an old name for Ucluelet, but Chief Arthur Mercer, Toquaht tribe, believed that it referred to Uchucklesit Inlet. Pronunciation in aboriginal dialect sounded vastly different from anglicized pronunciation. Compounding the mystery surrounding the type locality was the statement in the protologue,

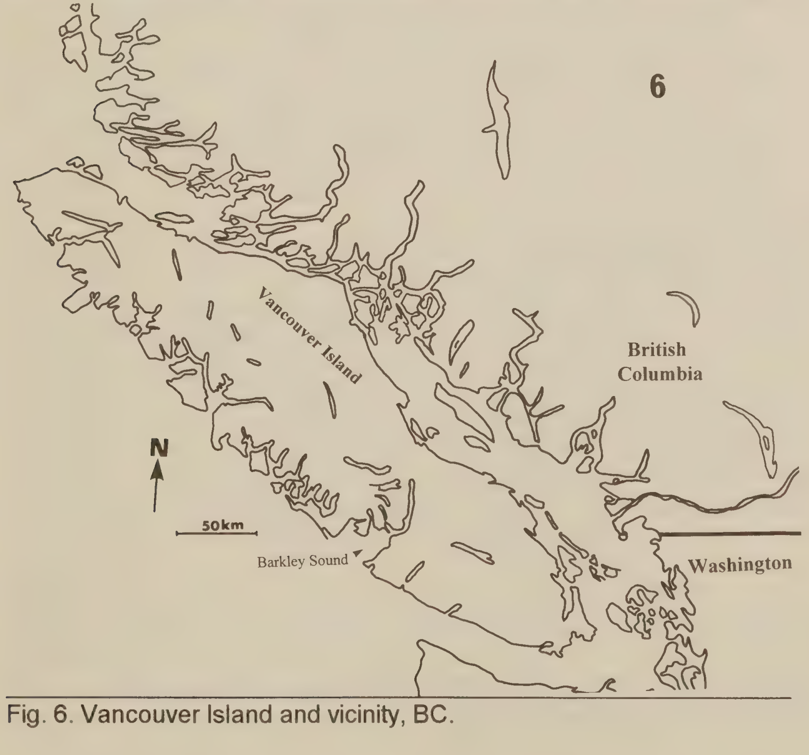


Fig. 6. Vancouver Island and vicinity, BC.

"My first impression on meeting this fungus in the Douglas fir woods of Vancouver was that it was neither *C. cibarius* nor C. odoratus....." This statement has been interpreted by Thiers (1985) and initially by us as indicating that the type habitat was under Douglas fir, *Pseudotsuga menziesii* (Mirb.) Franco. This is probably an incorrect assumption.

In Corner's notes "Vancouver" appears to be synonymous with Vancouver Island and not the cities of Vancouver, B.C., Canada (on the mainland) or Vancouver, Washington, USA. "Vancouver" is substituted by Corner for Vancouver Island in his key to chanterelles (Corner, 1966: 36) and in correspondence cited below.

Confusion resulting from similarly spelled and pronounced names for a traveller being escorted through foreign lands, and between various newly learned trees is understandable given the circumstances of Corner's

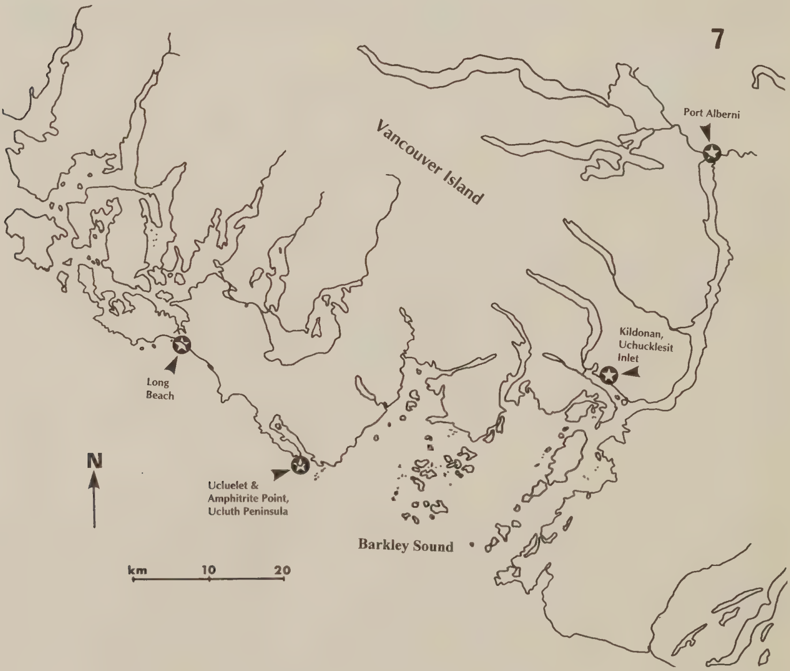

7
Port Alberni
Vancouver Island
Kildonan, Uchucklesit Inlet
Long Beach
N
Ucluelet & Amphitrite Point, Ucluth Peninsula
Barkley Sound
km 10 20

Fig. 7. Barkley Sound and vicinity, Vancouver Island, BC.

discovery of *C. formosus*. From 1929 to 1945, Corner was Assistant Director, Gardens Department, Straits Settlements, Singapore, Malaysia (Anonymous 1996; Corner 1981). In response to a query about the type locality for *C. formosus* and how he came to be on Vancouver Island in 1938, he sent a handwritten letter, dated 27 April 1994, to Redhead as follows (cited with verbal permission obtained by phone on Oct. 2, 1995):

> "Vancouver 1938. I left Singapore in early August on my second tour of home-leave and I decided to fulfil an ambition to see the great seaweed flora of the North West. I travelled in a cargo ship to Manila, then 3 weeks across the Pacific to find the ship gliding up the Columbia River in the early morning, with the fragrance of pine and poplar, to Portland, Oregon. A most wonderful way to enter the United States! Thence to Seattle, the Univ. of Washington and to Friday Harbour - seaweeds! A Canadian botanist and his fiançee took me to Victoria in Vancouver to Nanaimo where a fishery vessel was leaving Port Alberni for Barkley Sound, Amphitrite Point and Ucluelhet [sic] where I stayed a week. Seaweeds and some early fungi! I found the Cantharellus near Long Beach. I had been planning the Cantharellus monograph. It was not *C. cibarius* of Europe or any ally that I knew in Malaya, and I could not trace it in works by American mycologists."

Long Beach (Fig. 7, Clayoquot Dist., Wickaninnish Bay, N49°03' W125°43') is now included in a Canadian park, Pacific Rim National Park. It is not directly on Barkley Sound but is 20 km NW of Ucluelet, the village where Dr. Corner stayed. Amphitrite Point is immediately SW of Ucluelet on the tip of the Ucluth Peninsula (Fig. 7). Wickaninnish Bay has a long sandy beach fully exposed to Pacific Ocean swells. According to Mr. Barry Campbell (Senior Park Warden at Pacific Rim National Park, pers. comm., 1995) in the 1930s there was a dirt road from Ucluelet to Comber's Beach from which people walked along the beach to the summer residence of Dr. A.C. Lovekin, a wealthy America who owned Long Beach waterfront property from 1929 to 1975.

The vegetation in the Long Beach area is classified as the Outer Coastal Region, Nootka Section, Coastal Western hemlock [*Tsuga heterophylla* (Raf.) Sarg.] - Pacific silver fir zone [*Abies amabilis* (Dougl.) Forbes], Western red cedar subzone [*Thuja plicata* Donn], within a sitka spruce dominant strip (Harcombe & Oswald 1990). The Nootka Section "...is too

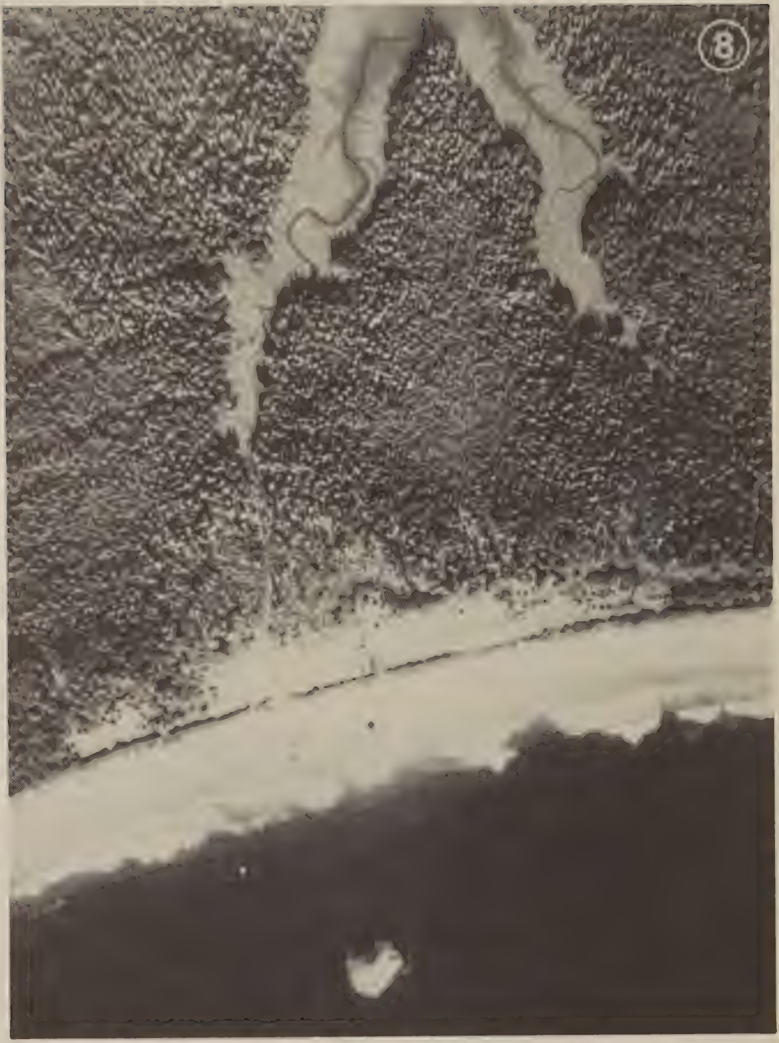


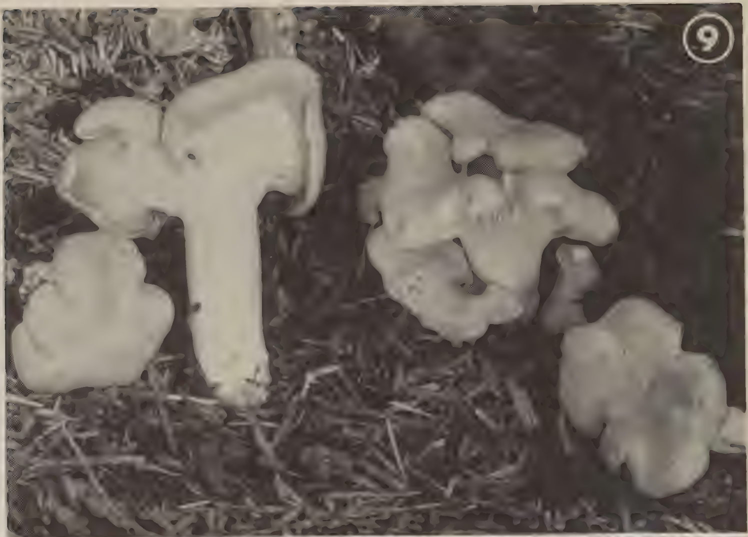
Fig. 8. Aerial photograph taken in 1930 (A3033.34) of Long Beach, now in Pacific Rim National Park, showing man-made clearing, existing forests, and two creeks draining into Grice Bay on the opposite side of the peninsula. Scale not known.

wet for coast Douglas-fir except on edaphically dry sites." (l.c., pg. 25). Douglas-fir is known in the park, which has been logged in the past, only in plantations. The Long Beach location is not edaphically dry but is instead very flat and very wet. An aerial photograph of the area (Natl. Air Photo Library, A3033.34) taken in 1930 (Fig. 8) and a series of adjoining photographs show second- growth forest interspersed with patches of older growth and some man-made fields. A 1969 provincial aerial photograph at the park shows the alder-overgrown [*Alnus rubra* Bong.] World War II-era Lovekin Hospital site as a cut rectangle next to forests that still exist and currently support chanterelle populations. Notably the forests lack Douglas-fir, and it seems highly unlikely that the type specimen of *Cantharellus formosus*, if collected near Long Beach, could have been collected under Douglas-fir. However, *Pseudotsuga menziesii* is common elsewhere on Vancouver Island, and therefore *Cantharellus formosus* could have been seen more than once on Dr. Corner's journey. For example, old-growth Douglas-fir currently exists along Uchucklesit Inlet near the former Kildonan Fish Cannery (N49°00'00" W125°00'00"), as well as in Cathedral Grove Provincial Park along the present-day highway leading to Port Alberni from Nanaimo.

In the 1930's the Kildonan Fish Cannery was the largest fish cannery on southern Vancouver Island, and fishery vessels sailing out of Port Alberni (Fig. 7), Corner's departure point, often stopped in Uchucklesit Inlet at Kildonan (Fig. 7). Given the unmatchable spelling of the published type location, "Uckeluelhet", and the divided opinions of local residents including First Nations people, it seemed possible that the spelling resulted from a blend of two location names, Ucluelet and Uchucklesit. Therefore, both locations were included in recent field work.

Meteorological Conditions in 1938

Climatological data obtained from Environment Canada from Ucluelet for the months of August and September, 1938, confirm that it had been a dry year. For the entire month of August and the first 3 days of September, 1938 only 28.9 mm of rain fell, with the last previously recorded precipitation, on August 16th (18 days earlier) cited as 14.7 mm. This is low even for the summer months. Mr. Campbell (l.c.) estimates average monthly rainfall in July and August in Pacific Rim National Park at 80 mm. Fog can contribute up to 300 mm each year, but the 20°C average maximum temperature in 1938 from August first to September third indicates fair weather during the day.



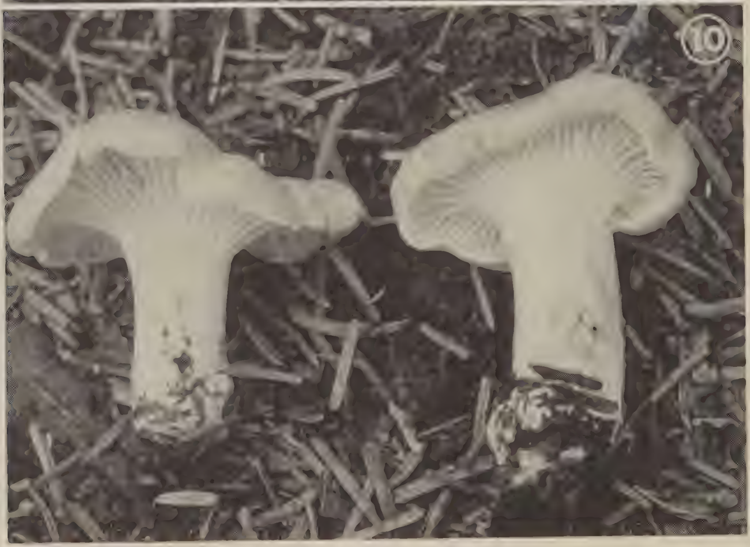


Fig. 9. *Cantharellus formosus* (scaly phenotype) at Kildonan (DAOM 220707), ca 2/3 x mag. Fig. 10 *Cantharellus formosus* (showing staining) at Long Beach (DAOM 220730), ca 1 x mag.

1995 Field work

Between September 12th and 15th in 1995 chanterelles were collected by Redhead on Vancouver Island in the vicinity of Barkley Sound from both second-growth forests at Long Beach and an old-growth forest at Kildonan. Observations in the field indicated that there are at least two different golden chanterelles in the Long Beach area: a medium sized one (Fig. 10), which ultimately we considered to be *C. formosus* (see below), and a very large one with intensely yellow hymenia (Figs. 15, 16) which we describe here as the new variety, *C. cibarius* var. *roseocanus* (see below following *C. formosus*). The former taxon appeared to produce several phenetically different fruiting body forms. In order to ensure that the samples obtained included all possible representatives of *Cantharellus formosus*, including morphological forms representative of those of the holotype, each different colour form was collected separately and characterized *in situ*. Colours were compared to Rayner (1970) , Kelly (1965), with the latter reported by colour names accompanied by numbers in square brackets, or Ridgway (1912). Samples of fresh tissue from selected growth forms were preserved in concentrated NaCl/CTAB solution (Rogstad 1992) for later extraction and analyses of DNA by Danell in both Corvallis, OR and Sweden. The results of the DNA analyses will be reported in detail elsewhere (Danell et al., in preparation). The following habitat and morphological data are from collections initially identified as *C. formosus* in the field.

Cantharellus formosus data

TYPE LOCALITY (LONG BEACH)

Here all forests grow on old shore dunes and glacial deposits. The site furthest from the shore (near the former Lovekin Hospital) consists of *Tsuga heterophylla* and *Picea sitchensis*, with an understorey of *Gaultheria shallon* Pursh, *Maianthemum dilataum* (Wood) Nels. & Macbr., *Vaccinium ovatum* Pursh, *V. parvifolium* Smith, *Menziesii ferruginea* Smith, *Polystichum munitum* (Kaulf.) Presl, *Blechnum spicant* (L.) Roth., and occasional *Equisetum* spp. *Cantharellus formosus* (Fig. 10) exhibited at least two conspicuously different colour forms described below:

(A) Richly pigmented forms in most sites (Fig. 10) that varied in stature, dryness, and in subtle orange and pink shades of the pilei and hymenia. The pastel-coloured pilei varied from light to moderate orange yellow [70, 71, mostly with a slightly more pinkish tint], with a faint light yellow pink [28] or marginally with an ephemeral salmon-coloured hoar, and on some light yellow brown [76] centrally. Typically they were convex later becoming depressed centrally, and the surface was dry, bearing a hoar-like coating when young, later becoming suede-like, then matted or virtually glabrous. The salmon to saffron coloured hymenophores consistently showed pinkish tints (paler than light orange [52] to slightly pinker than pale orange yellow [73]). The more or less cylindrical to tapered stipes were salmon, saffron coloured, or slightly pinker (between light yellow pink [28] and pale orange yellow [73]), with the colour more intense at the apex from the descending hymenium and becoming oranger towards the base (paler than light orange yellow [70]). The solid stipes, smooth on the exterior except for fibrils which became more conspicuous after handling, stained at first luteous before darkening.

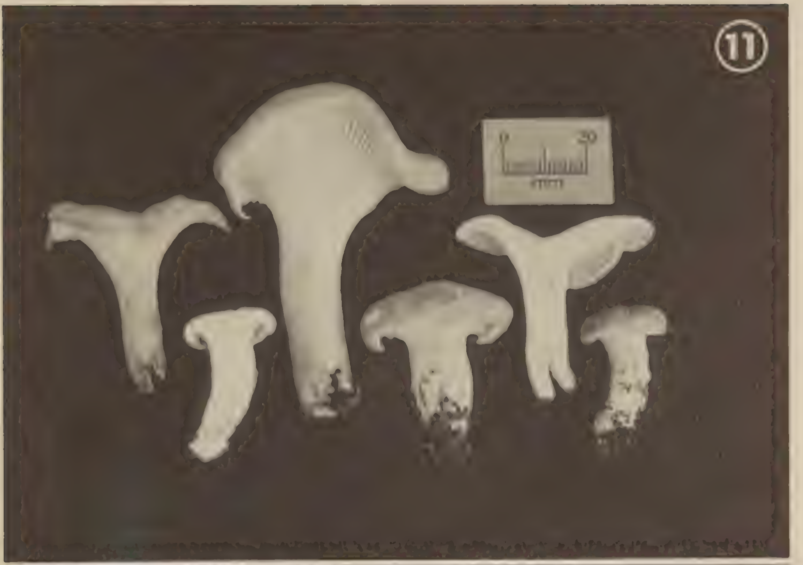
(B) One form (DAOM 220728), collected only once from a heavily shaded burrow entrance, apparently failed to fully develop yellowish colouration and had salmon to rosy buff coloured pilei with whitish to pale yellow pink [31] hoary margins, yellow white [92] to buff hymenophores (salmon-coloured in some) lacking obvious orange colouration, and whitish stipes with salmon to pale yellow pink [31] chalky to frosty coatings on the upper half. These anaemic basidiomes stained yellow as in the other forms, however.

Banding on the stipes and scale formation on the pilei, as shown in Corner's icones were not evident on these collections from Long Beach in September 1995. However, these features showed up on collections from the alternative site at Kildonan as noted below.

Uchucklesit Inlet site (Kildonan)

Vegetation on the slopes immediately behind Kildonan consisted of mature *Tsuga heterophylla*, ancient *Pseudotsuga menziesii* of undetermined age, and scattered *Thuja plicata*, with an understorey of *Polystichum munitum*, *Blechnum spicant*, *Vaccinium ovatum*, *V. parvifolium*, and *Menziesia ferruginea*. A few *Picea sitchensis* were present as scattered isolated trees in the vicinity but not at collection sites.

Among the evident variation of growth forms exhibited by these chanterelles (Figs. 4, 9, 11) were some that matched forms described and illustrated by Corner (1966). Fruitings from one cluster (DAOM 220707) had developed appressed dark scales on 16 - 60 mm broad pilei (Figs. 4, 9) and hymenia with very pronounced pinkish tones. These 20 - 72 mm tall basidiomes were initially convex with incurved even margins when young, becoming plano-convex and ultimately with up-lifted sides,



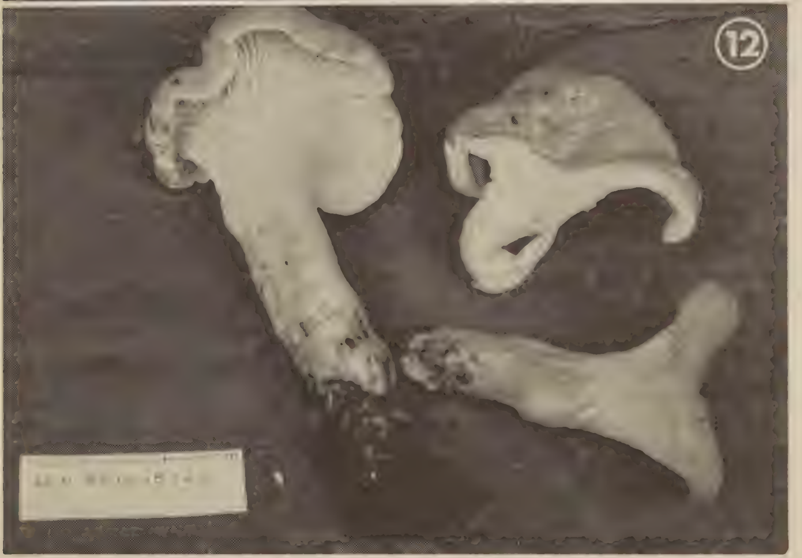


Fig. 11. *Cantharellus formosus* from Kildonan, BC, (DAOM 220707). Fig. 12. Same, from Mt. Hood, OR (LLN 95.10.18-25).

a depressed centre, and with shallow indentations in places along the margins. Pileal surfaces were dry, with very suede-like (chamois), very pale margins, either concolourous with the hymenium or paler and pinker, and slightly sordid centres (light yellow brown [76] to medium orange yellow [71]). Smaller fructifications had unbroken dull surfaces that on larger ones had broken up into an adder-banding pattern or diffractive appressed patch-like scales which were darker than the paler, brighter background colour. The decurrent hymenophores consisted of folds up to 1 - 1.2 mm deep, forked approximately 2/3 the distance from the margins, and occasionally anastomosed. The hymenium becoming smooth at the stipe apex and thus forming a more or less distinct line of demarcation, was slightly pinker than pale orange yellow [73] and slightly brighter than salmon, exhibiting more of a pinkish hue when viewed at certain angles. The solid 15 - 45 mm X 4 - 15 mm tapering to narrowly fusoid stipes (generaly concolourous with the hymenium) were finely fibrillose on the lower half (the fibrils especially noticeable after handling) and bruised slowly pale yellow [89], later darkening to dark orange yellow [72].

Other samples lacked scales, were highly convoluted, or bore secondary growth of epitopical hymenia. One sheltered collection (DAOM 220710) from a moist ravine was more intensely orange-coloured (presumably a result of greater water-saturation), with a glabrous brilliant orange yellow [67] to soft orange yellow [68] pileus with a medium orange yellow [71] centre, generally pale orange yellow [73] (between pale luteous and saffron) hymenophore,and a medium orange yellow [71] to soft orange yellow [68] stipe with a marbled whitish interior. This sample was more representative of specimens frequently seen elsewhere during wet weather throughout its range in British Columbia and the Pacific Northwest.

Interpretation of variation found in the vicinity of Barkley Sound

Microscopically all the collections presumed to be of *C. formosus* were similar to one another (data are summarized below in the species redescription). RFLP-generated data by Danell et al. (in preparation) demonstrates that all topotypic material suspected of being *C. formosus* -- regardless of whether from the Long Beach or Kildonan sites -- group together and are clearly separable from taxa more closely allied to *C. cibarius* and *C. subalbidus*. The *C. formosus* RFLP-group was also represented by DNA samples from chanterelles collected in Washington, Oregon and northern California. The ITS region from the large yellow chanterelle with the brilliant yellow hymenium found at Long Beach behaves similar to the region from *C. subalbidus* and *C. cibarius* (of which it is a new variety, *q.v.*). Morphological data from *C. formosus* collections from the two locations on Vancouver Island, both the Long Beach locality (indicated as the type locality Corner 1994, pers. comm) under mixed sitka spruce and western hemlock and the Kildonan site on Uchucklesit Inlet off Barkley Sound under mixed Douglas-fir and western hemlock confirm the existence of dry weather forms that match most closely Corner's description of the original specimens collected in 1938. Additionally, in the field, moister, more saturated fruitbodies of *C. formosus* appeared significantly brighter orange and less pink and lacked scales or floccules, facts which have led to continual confusion in distinguishing *C. formosus* from *C. cibarius* (especially in the absence of fresh local *C. cibarius* var. *cibarius* for comparison). Yellow staining of the stipe, pileus, and hymenophore is normal for *C. formosus*, but variation exists. Corner (1966) did not comment on bruising reactions which both Thiers (1985) and Tylutki (1987) correctly found to be characteristic of *C. formosus*. The banding on the stipe depicted in the colour plate with the protologue by Corner appears typical for some fruitbodies that have expanded during dry weather. Microhabitat appears to have a strong influence on fruitbody development. Darker floccules and scales on the pileus resembling those depicted by Corner are also features of some dry weather specimens. Additionally, completely shaded fruitbodies appear to lack full development of one pigment, presumably the carotenoid component. Bruising, if noticed immediately, is yellow, but if observed in later stages is orange to ochraceous (Fig. 12).

Specimens in bins at commercial buying stations recognized by Redhead as *C. formosus* (eg. Sept. 16th, near Ladysmith, Vancouver Island - Fig. 3), in fresh food markets (eg. Sept. 20th, Portland, OR; Nov. 7, 1993, Seattle, WA - Fig. 1), and in sorting operations of an exporting company in Alberta (Sept. 1996, of material reportedly originating from the Queen Charlotte Islands, B.C.) obviously have been extensively handled. Typically they have been bruised when picked, dumped onto one another into containers, dumped into weighing bins, further handled during sorting, dumped into holding bins, and then sent to market, all the while partially drying and darkening. These chanterelle fruitbodies look much oranger than fresh specimens because of the bruising reactions. The harvested chanterelles shown by Rowe (1997: 13, colour figure 4) from British Columbia appear to be *C. formosus*, with one or two possible exceptions.

It is clear from personal observations by all three authors at markets and buying stations, that the main species being harvested in British Columbia and the Pacific Northwest, is *Cantharellus formosus*. Additionally, data on harvesting and ecology collected over 10 years at the Oregon Mycological

Society chanterelle study plots is for *C. formosus* and not *C. cibarius*. Norvell[2] arrived at this conclusion during the course of this study and her participation as a subcontractor for the USDA Forest Service following up on FEMAT documentation. Similarly, examination of samples from the northern California plots deposited by Sime at the University of Tennessee (TENN), suggests that the data gathered on chanterelles by Largent & Sime (1995) applies to *C. formosus*, not *C. cibarius*.

Habitat data on *C. formosus* should be re-examined and investigated. This species was found in two forest types near the type locality where the only tree species in common between the sites was western hemlock. However, there are indications that it can occur under lodgepole pine, and it has been repeatedly been found under Douglas fir (although usually with hemlock). The related species, *Cantharellus cibarius* is known to have strains which are either host specific (Danell & Fries 1990) or with broad host ranges (Moore et al. 1989). Host specificity may factor into the gross appearance for the fruitbodies from different strains.

The following is a redescription of *Cantharellus formosus* based upon information from topotypic material and supplemented by additional data from PNW collections. It is here named the **Pacific Golden Chanterelle**.

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[2] Norvell, L.L. 1995. ROD: Strategy 1 - fungal species evaluation. Report submitted to USDA Forest Service and USDI - Bureau of Land Management [to be incorporated into a governmental report by M. Castellano, For. Res. Lab., Corvallis, OR]

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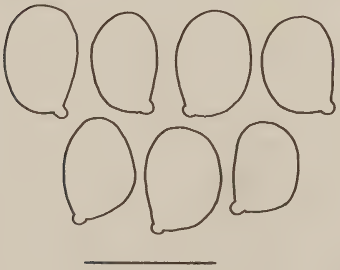

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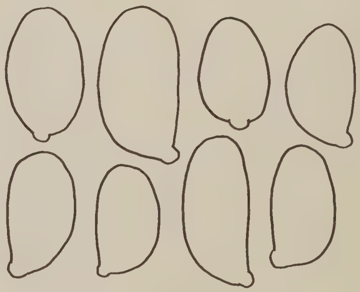


Fig. 13. *Cantharellus formosus* basidiospores (DAOM 220725). Fig. 14. *Cantharellus cibarius* var. *roseocanus* basidiospores (Holotype, DAOM 220723). Scale = 10μm.

Cantharellus formosus **Corner,** Cantharelloid Fungi, Ann. Bot. Mem. 2: 45 (1960).

Figs. 1,3-5, 9-13.

Basidiomes brightly coloured dull orange yellow to orange, fleshy, and medium sized, with a pileus between 2 and 14 cm wide, well developed hymenophore folds typically paler and brighter than the pileus with a hint of pink, and a medium sized solid fleshy stipe coloured much like the pileus. Flesh whitish to paler than Ivory Yellow (Ridgway) except immediately below the pigmented surfaces, mild tasting and not strongly odoriferous. Edible. Spore print yellowish white (26 yrs. old, DAOM 142211).

Normal colouration on the pileus from three distinct pigments, a very thin centrally concentrated fuscous layer overlying a brightly coloured, orange yellow zone of at least two pigments extending <1 mm into the flesh. Under wet conditions brilliant to soft orange yellow [apricot to orange or saffron - Rayner; Antimony Yellow or Deep Chrome - Ridgway] coloured with a slightly duskier centre and largely obscured overlying fuscous layer. In strong shade salmon to rosy buff-coloured, with yellow pigment apparently not fully developed. Upon partial drying or in dry conditions the subhygrophanous fuscous layer becoming more conspicuous, appearing either as an even dusky coating and then the surface medium orange yellow to light yellow brown (or Yellow Ocher or Warm Buff - Ridgway), or breaking up into conspicuous appressed darker patches in scales or bands on a brighter background. Bruising from handling inconspicuous to conspicuous, inducing a slow yellowing which changes to ochraceous, most in freshly picked basidiomes that have developed under humid but not dripping wet weather conditions.

Surface texture under humid conditions like chamois or suede when young and never beaten by heavy rain or dried by hot weather, more often subglabrous, subpolished, or even appressed scaly and roughened, or sometimes developing epitopical hymenial patches.

Hymenophore decurrent, consisting of radiating well developed folds (up to 2 mm deep) tending to fork towards the margins, depending on growth conditions either crowded (1 mm apart) or subdistant (2 mm apart) and varying from scarcely anastomosing to distinctly intervenose with ladder-like branches, occasionally developing cracks when growth continues afterwards in dry weather. Colouration pale orange yellow (Kelly) to saffron (Rayner) or Pale Pinkish Cinnamon to Capucine Buff in some areas (Ridgway) when moist to salmon (Rayner) in drier forms, or even yellow white to buff on heavily shaded specimens. Bruising yellow then ochraceous if fresh and humid.

Stipe solid, 40 - 80 mm long, 4 - 22 mm wide, equal or tapered downwards (almost never upwards) and sometimes compressed, concolourous with or slightly paler than the pileus (Ridgway -- Maize Yellow or Buff Yellow to Warm Buff) and usually not as dusky, varying surface and colouration dependent on growth conditions, apically sheathed by a decurrent smooth hymenium extending beyond the folds, with sheath occasionally fragmenting into small patches or bands and exhibiting the salmon colours of the hymenophore unless bruised. Lower portions subglabrous and bruising yellow then ochraceous (Kelly), Capucine Yellow or slightly paler than Buckthorn Brown (Ridgway), more conspicuously fibrillose after handling.

Pileipellis initially, and often remaining so towards the incurled margins, a radially inclining turf of free hyphal ends exhibiting many long, bluntly tipped hyphal ends, soon collapsing into a radially matted, thin, fuscous layer, sometimes aggregated into flat appressed darkened scales which especially develop during growth phases in dry weather. Hyphae and hyphal ends 4-9μm diam. with fuscous contents and smooth, slightly thickened walls up to 0.8μm thick. Hypodermal hyphae slightly more compactly arranged than hyphae deeper in the trama and more heavily pigmented with yellowish contents. Tramal hyphae 3.5-15μm diam, subhyaline to faintly yellowish, interspersed with oleiferous hyphae, 4-5μm diam with refractive contents. Hymenial cystidia absent. Hymenium thickening (-167μm), hence the subhymenium a thick ill-defined zone. Basidia 4-(5-)6-spored, clavate, 86-120 X 8-11.6μm; sterigmata large, 5-7μm long, incurved, with the fifth and sixth further from the apex. Basidiospores (Fig. 13) 7.2-9.2 X 4.7-6.1μm, N = 10, av. 8.0-8.2 X 5.0-5.5μm, L/W 1.47-1.6, broadly ovoid to ellipsoid or broadly cylindrical in face view, slightly inequilateral to broadly cylindrical in profile, typically with a broadly rounded and nontapered nearly truncated apex in profile, very rarely constricted centrally, smooth, thin-walled, hyaline, nonamyloid. Hyphae in the stipe similar to the tramal hyphae but more clearly vertically aligned. Basal mycelial hyphae smooth, thin-walled, 2.3-5μm. Clamp connections abundant in all tissues.

Chemical tests (on LLN 94.10.17-1 after refrigeration for several days): $FeSO_4$ - pale green, leaving a bright orange ring after evaporation; PDAB - bright orange yellow after 30 minutes (bright yellow after 15 minutes, yellow orange immediately); no reactions noted with ParaCresol, Syringaldazine or KOH solution spot tests.

Habit and Habitat: Solitary to gregarious, often in small clusters or slight arcs, on bare and mossy needle beds, sometimes near coarse woody debris, in both second growth and old growth western North American forests, most often under hemlock (*Tsuga heterophylla*) sometimes mixed with Douglas fir (*Pseudotsuga menziesii*), spruce (*Picea sitchensis*) and other associates, and at least once seen in virtually pure *Pinus contorta* Dougl. stands on dunes in Oregon.

Specimens examined: Canada: British Columbia (all DAOM): North Vancouver, Capilano Canyon, 8 Oct 1973, SA Redhead (220890), Lynn Valley, 30 Sept 1961, RJ Bandoni et al. (91075); Vancouver, Point Grey, Sept 1947, WG Ziller (22097); Vancouver Island, Bowser, 8 Oct 1952, AT Foster (44769), 9 Oct 1952, DJ MacPherson (45006), Vancouver I., Cowichan, 25 Oct 1942, A Nicholls (4190), Vancouver I., Caycuse, 15 Oct 1969, HM Craig & D Chu (130447), Vancouver I., Lake Cowichan, Gordon Bay, 18 Oct 1971, JH Ginns (142211), 19 Oct 1971, JHG (142207), Vancouver I., L. Cowichan, Miller Creek, 27 Sept 1979, SAR (220891); Vancouver I., Pacific Rim National Park, Wickaninnish Bay, N49°03' W125°43', Long Beach, 15 Sept 1995, SAR (220727 to 220731); Vancouver I., Barkley Sound, Uchucklesit Inlet, Kildonan, N49°00'00" W125°00'00", 12-13 Sept 1995, SAR (220707 to 220714). **USA: California:** Del Norte Co., Wilson Creek Rd., ~5 mi N Klamath on Hwy 101, N41°05', W124°04', 23 Oct 1982, HD Thiers 45201 (SFSU); Del Norte Co., Alder Camp Rd, Jedediah Smith State Park, N41°78' W124°.10', 3 Nov 1984, HDT 48125 (SFSU); Humboldt Co., Big Lagoon State Park, N41°16' W124°13', 3 Nov 1984, MT Seidl 178 (SFSU); Humboldt Co., N41°14', W124°16', Patrick's Point State Park, study plots, sample from season of 1995, AD Sime (TENN 54702); Mendocino Co., N39°275' W123°79', Pygmy Forest, Van Damme State Park in Fern Canyon, 22 Nov 1986, H Saylor 3764 (SFSU). **Oregon:** Cascade Head Experimental Forest, N45°0447', W123°9175', 10 Oct 1970, AH Smith 78909 (MICH); Clackamas Co., Mt. Hood Natl. Forest, Bull Run Watershed, Oregon Mycol. Soc. Chanterelle plots, N45°51' W122°10', elev. 2010'; 17 Oct 1994, LL Norvell 94.10.17-1 (WTU) **(Fig. 5)**, additionally hundreds of specimens and in situ measurements observed by LLN and OMS members at this site, deposited in WTU; Wildcat Mountain, ca 3500' elev., 18 Oct 1995, LLN 95.10.18-16, LLN 95.10.18-25 **(Fig. 12)**, LLN 95.10.18-26 (all WTU & DAOM).

Published illustrations of *C. formosus*: Corner (1966: type line drawing, fig. 1, p. 3, colour painting plate 1, fig. A); Tylutki (1987: black & white photograph, p. 59).

Additional illustrations published as *C. cibarius*, but suggesting *Cantharellus formosus* instead: Arora (1986: colour figure 178, large wet specimen, but not figs. 175, 177 which are eastern North American taxa); Arora (1991: colour photograph, bottom page 3 - dryish weather, but not species figured elsewhere on pages 1-3); Bandoni & Szczawinski (1976: colour photograph p. 39); Fischer & Bessette (1992: colour photographs in market p. 5, possibly p. 24 if western in origin); Lincoff (1981), colour photograph, pl. 427, presumably western); Miller (1972: colour photograph, pl. 259, if western); Persson & Mossberg (1994: colour painting, p. 84); Schalkwijk-Barendsen (1991: colour painting, p. 165); Smith (1949: stereo colour slides, reel 4, no. 27, excellent illustration).

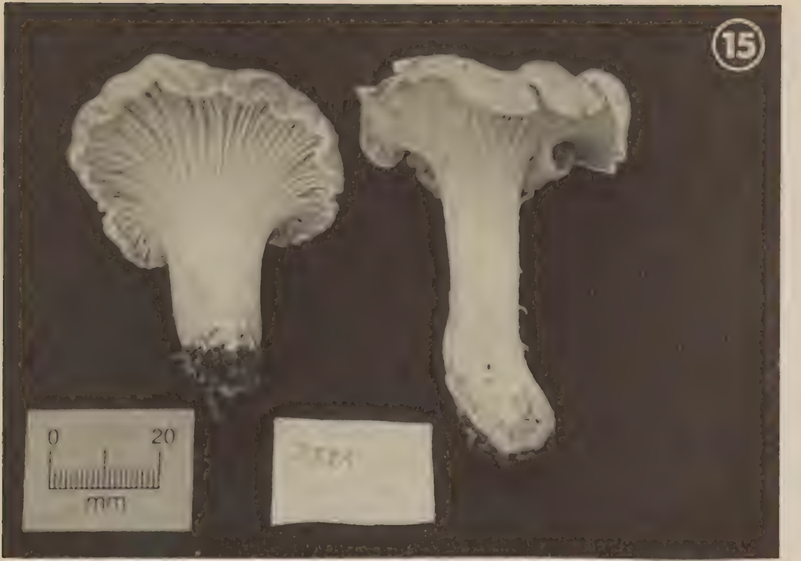
Discussion: Two scaly varieties of *C. cibarius* have been described and were included in Corner's key in group "C", series "2" with *C. formosus*. *Cantharellus cibarius* var. *squamosus* Pöll apud. Murr (1916) from Austria has dark squamules on an egg-yellow pileus and presumably an egg-yellow hymenium, while *C. cibarius* var. *squamulosus* Blytt (1904) from

Norway has a rufous brown pileus and therefore neither matches *C. formosus*. These varieties described from Europe require additional study if ever rediscovered. Corner suggested that they might better be compared to C. *friesii* Quél., which also has been reported to have darker squamules. Currently there is no accumulated body of evidence to determine whether either variety was based upon genetically different or stable populations that could ever be relocated or were simply based upon unusually weathered or environmentally induced basidiomes. In North America, *C. formosus* has been shown to be a common species endemic to the west coast, that can be repeatedly recollected. It appears to be confined to western temperate rain forests. Examination of collections labelled "*C. cibarius*" in DAOM from across North America and Europe failed to reveal additional collections of *C. formosus* outside of western British Columbia, Washington, Oregon and northwestern California. Its recognition at the species level is supported by the fact that its rDNA ITS is approximately 200 base pairs longer than that in *C. cibarius*, i.e. approximate rDNA ITS lengths of 1600bp versus 1400bp (Daniel et al., in preparation).

Our studies support the suspicions and statements made by several authors (Petersen 1969; Thiers 1985; Tylutki 1987; Norvell 1995a) who believed that *C. formosus* was a common western species. Its listing as a Strategy "1" fungus (USDA/DI 1994a,b) should be re-evaluated and its status changed in consideration of its widespread use as a commercially harvested species.

Part II - *Cantharellus cibarius* var. *roseocanus*

The second, brighter and more yellow-coloured species of chanterelle (Figs. 15, 16) at the Long Beach site occurred in abundance in the forested band closest to shore. It differed conspicuously from *C. formosus* and more subtly from *C. cibarius* var. *cibarius* as the latter is known to us. Apparently it was not seen by Corner in 1938. On Vancouver Island, this new taxon occurred in the absence of hemlock under nearly pure stands of Sitka spruce (*Picea sitchensis*) with Western Red cedar (*Thuja plicata*) occasionally present. Understorey growth there was restricted to salal (*Gaultheria shallon*), with scattered sedges or grasses occasionally present. Association with spruce might be important. Specimens resembling this coastal Vancouver Island taxon were later collected in Skamania County, Washington State by Jan Lindgren in 1996 and air-freighted fresh to Redhead. Redhead determined that they differed from the 1995 collections by being slightly denser and hence firmer. The Washington collection also was found under spruce (*Picea* sp.) but in the



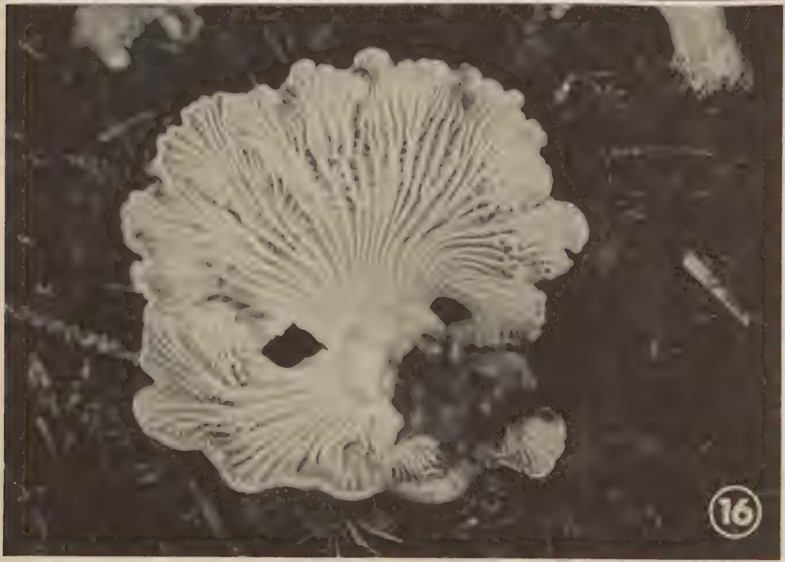


Fig. 15. *Cantharellus cibarius* var. *roseocanus* from Long Beach, BC, (DAOM 220725). Fig. 16. Holotype, large pileus (120 mm diam) of *Cantharellus cibarius* var. *roseocanus* (DAOM 220723).

presence of fir (*Abies* sp.) and mountain hemlock (*Tsuga mertensiana* (Bong.)Carr.). Lindgren, another longtime volunteer researcher working on the Oregon Mycological Society chanterelle plots on Mt. Hood, noted that this fungus could clearly be differentiated in the field from *C. formosus*, the species she and the authors now know to be present in the OMS plots. The new variety had been collected once before by Redhead in 1982 on the Queen Charlotte Islands, B.C., at which time the brightness of the pale luteous hymenium was noteworthy.

The identity of this second yellowish western chanterelle is problematic. Although RFLP data alone cannot prove phylogenetic relationships, the RFLP data (Danell et al., in preparation) suggests a closer link to *C. cibarius*, as do morphological data (more elongated spores, paler pileipellis hyphae). From *C. cibarius* var. *cibarius*, the new chanterelle differs most conspicuously by the colourful yellowish pink hoary coating that is seen marginally on pristine material or overall on pristine buttons. Where the incurved margin is juxtaposed over the deeply yellow coloured hymenium (totally lacking pinkish hues) there is a marked contrast of colours. However, the superficial pinkish coating becomes watersoaked and can be difficult to detect on older specimens which have been exposed to the elements. *Cantharellus cibarius* var. *salmoneus* Corbière (1929) from France as treated by Corner (1966) might appear to be similar, but it was said to have a salmon-coloured hymenium and stipe with a virtually normally coloured pileus, and therefore is distinct.

Smith & Morse (1947) may have collected the new chanterelle on Mt. Hood, Oregon, and then published a photograph labelled "*C. cibarius*" (their fig. 4, erroneously cited in their text as fig. 5). They reported the pilei as "light vinaceous cinnamon" and the disc "pinkish cinnamon" when fresh. However, they did not provide any additional details on the hymenium and stipe colour, which should have been orangish yellow if it matched our fungus, or pinkish yellow if it were a large specimen of *C. formosus*. Smith & Morse suggested "*C. amethysteus* Quél." might be close to their Mt. Hood fungus.

"*Cantharellus amethysteus* Quél." (or, more correctly, *C. amethysteus* (Quél.)Sacc.) was treated by Corner (1966) as a variety. He reported that *C. cibarius* var. *amethysteus* Quél. as having "lilac down" on an otherwise egg-yellow pileus. This description could apply equally to the PNW and British Columbian taxon. However, coloured photographs and watercolour plates of *C. amethysteus* from Europe show what could be considered several taxa, one with exceedingly shallow pale hymenial folds and virtually smooth pileus (Gasparini et al. 1987), a second with a conspicuously scaly pileus and much deeper, lamellae-like hymenial folds (Manuel 1982), and a third with bands of a patchy lilac overcoating (Rea 1910). Quélet (1882 p. 397) originally described *C. cibarius* var. *amethysteus* from under beech (*Fagus*) in the Vosges mountains in France as having an egg-yolk coloured stipe, a paler yellow hymenium, and a pale egg-yolk coloured pileus covered with a lilac-tinted flesh-coloured downy coat ("Stipe...jaune-d'œuf .....Chapeau jaune-d'œuf pâle, couvert d'un *léger duvet incarnat lilacin*..... Plis épais, rameux, réticulés, jonquille....,"). Quélet (1886 p. 138) later changed his description to, "Pileo.... vitellino.... margine flocculoso, carneoso-violaceo; stipe... vitellino.... lamellis flavis...". Under the name, *Craterellus cibarius* var. *amethysteus* (Quél.)Quél., he (Quélet 1888) again modified his description, "Stipe.... crème jonquille..... Peridium *jaune d'œuf* clair, couvert d'un *léger duvet incarnat lilacin*.... Plis... *jonquille*." Nowhere are scales mentioned. Rea (1910, 1922) described similar finds in beech forests in England, notably lacking scales, possessing concentric banding of the lilac down, and having egg yellow hymenia (his pl. 12, 1910). It is clear that for the French/British fungus, there is always a conspicuous downy layer on the pileus within which are mixed more bluish spectral elements ("lilacin" or "violaceo") than are found in the western North America fungus. Currently, *Cantharellus cibarius* var. *amethysteus* is recognized as a distinct taxon at two taxonomic levels, the varietal (Corner 1966; Gasparini et al. 1987; Kühner & Romagnesi 1953; Manuel 1982; Pilát 1951; Quélet 1882, 1886, 1888) and the specific as *C. amethysteus* (Quél.)Sacc. (Dennis et al. 1960; Persson & Mossberg, 1994; Rea 1910, 1922; Saccardo 1887). If all 3 European growth forms as represented by the illustrations cited above represent one taxon, it is a fungus where fruit-bodies can develop intense lilac to vinaceous pigments in a thick downy coat which may under some conditions break up into scales (much as the superficial layer on *C. formosus* does), and which appears to be mycorrhizal with *Fagus*. Persson & Mossberg (1994, pgs. 43-44) illustrated a range of forms for *C. amethysteus* in two water colour plates, showing gradation between the various forms found by other authors, and comparing it to *C. cibarius* and *C. pallens* Pilát. These authors concluded that the amethysteus-tinted fungus was a distinct species. Whether it is a species or variety it differs from our North American taxon sufficiently to be separated.

Our western North American taxon forms a less well-developed coating (i.e. hoary, rather than downy). This hoary coating is not as intensely pigmented as that described for *C. cibarius* var. *amethysteus*, but is rather a pastel pinkish colour becoming nearly white on the edge. When water-soaked, the thinness and delicacy of the coating leads to its obliteration, which reveals the inherent yellow colouration beneath the pinkish coating. The pileus lacks scales and lilac tints. The more prominent yellow colour makes the western taxon more like *C. cibarius* var. *cibarius.*

None of the many illustrations of *C. cibarius* var. *cibarius* from Europe depict a pastel pinkish hoary margin or bloom over the disc at any time (Anonymous 1982; Bon 1987; Breitenbach & Kränzlin 1986; Bulliard 1781-1782; Caspari et al. 1968; Clémençon et al. 1980; Cordier 1876; Courtecuisse & Duhem 1995; Fries 1860-1866; Gasparini et al. 1987; Jordon 1995; Læssøe et al. 1996; Manuel 1982; Marchand 1971; Moser & Jülich 1989; Nilsson et al. 1978; Nonis 1982; Pegler & Spooner 1992; Phillips 1981; Rinaldi & Tyndalo 1974; Romagnesi 1958; Ryman & Holmånsen 1884; Schlittler & Waldvogel 1972; Sowerby 1795-1797), nor has it been noted by Danell on *in situ* fruitings in Sweden or other European countries. It is noteworthy that typical eastern North American *C. cibarius* seen by Redhead *in situ* also lacks this pinkish bloom (cf. Homola 1993, colour photo #1; Farlow & Burt 1929; Bigelow 1978). Dr. Ronald Petersen, noted chanterelle expert, kindly permitted Redhead to view, at the University of Tennessee, his original water colour icones (both published and unpublished) of North American and European variants of *C. cibarius.* Again a precise match could not be made between our western taxon and any of the chanterelles illustrated by Dr. Petersen.

In North America several new species in the *C. cibarius* complex, along with varieties possibly representing unnamed species, have been reported by Smith (1968), Petersen (1969, 1979, 1986) and Feibelman et al. (1996). Petersen (1969) described, and later depicted in colour (Petersen 1986), two colour forms of *C. cibarius* from the southern Appalachian mountain range that produced yellow and cream-coloured spores respectively. He indicated that both forms also occurred in the western United States along with the more common *C. formosus*. Examination of both published and original water-colour plates confirms that neither shows precisely the same pattern of pigmentation with a marginal pinkish hoary coating common to our western taxon. It is possible that two somewhat similar western taxa were being compared to the southern Appalachian chanterelles, namely our taxon and a chanterelle species commonly collected under oaks in California. Arora (1991) published under the name *C. cibarius* colour pictures of what appear to be three different taxa: *C. formosus* (p. 3); the oak-associated species (p. 2); and a richly-coloured taxon, possibly either our variety or the true *C. cibarius* (p. 1).

To date, there has been no hard evidence published in support of the occurrence of typical *Cantharellus cibarius* var. *cibarius* in the Pacific Northwest (USA) or British Columbia, although there are collections labelled *C. cibarius* from B.C. in DAOM which lack field notes and are not *C. formosus*. When one excludes the fungus now known to be *C. formosus*, the other chanterelle closest to *C. cibarius,* appears to be the fungus described below as *C. cibarius* var. *roseocanus*, an ectomycorrhizal associate of spruce and perhaps other conifers. Until stronger evidence becomes available to indicate specific distinctions, we opt to recognize the new chanterelle at the varietal level.

***Cantharellus cibarius* var. *roseocanus* var. nov.**: *differt a C. cibarius* var. *cibarius colore pilei marginati rosei.*

Holotypus: DAOM 220723 (SAR 7994).

Pileus 20 - 120 mm diam., moist, glabrous, initially plano-convex with inrolled edges, becoming depressed centrally and highly lobed and crisped marginally, sometimes shallowly to deeply infundibuliform or nearly multipileate when deeply incised and forming fan-shaped lobes, varying from pale yellow pink [31] to gray yellow pink [32] from a heavy hoar especially dominate marginally, to brilliant orange yellow [67] centrally when young, when more mature soft orange yellow [68], medium orange yellow [71], brilliant orange yellow [67] or light orange yellow [70], masked on margins by a pale yellow pink [31] to pale orange yellow [73] hoar-like coating (salmon coloured when both pigmented layers blend), and on some pilei vaguely concentrically ringed by broad bands.

Hymenophore when young light yellow [86] to pale orange yellow [73], with age light orange yellow [70] to brilliant orange yellow [67] or pale orange yellow 73]; hymenium decurrent, forming shallowly anastomosing folds that fork two to three times towards the margins, ultimately ribbed, with ribs forming anastomoses in parts, when young the folds 1 mm distant, becoming 2-4 mm distant and up to 5 mm deep in age.

Stipe typically short relative to the pileus width but occasionally elongated, 15 - 50 mm long, 7 - 24 mm wide apically, solid, with a tapered to rounded base; surface light orange yellow [70] to light yellow [86], variably sheathed by a decurrent hymenium which imparts light orange yellow [70] to brilliant orange yellow [67] colour to the surface, this sheathing layer sometimes fragmenting from stipe elongation, sometimes banded, sometimes patchy, towards the base, on older basidiomes the unsheathed stipe pale orange yellow [73] or whiter or grayer but often with some more intensive orange or yellow traces basally. Without obvious immediate bruising, but darker on old damaged patches.

Dark gray fibrils of a dematiaceous contaminant seemingly staining the base of some stipes.

Spore deposit (in beads on spider webs across the hymenium) concolourous with the hymenium, i.e. orangish yellow.

Pileipellis initially, and often remaining so towards the incurled margins, a radially inclining turf of free hyphal ends which soon collapse into a radially matted, thin, microscopically hyaline to yellowish layer, exhibiting many long, bluntly tipped hyphal ends. Hyphae and hyphal ends 3.5 - 5.5µm diam., smooth, with slightly thickened walls up to 0.8µm thickness. Hypodermal hyphae slightly more compactly arranged than deeper in the trama, and more heavily pigmented with yellowish contents. Tramal hyphae 2.5-9µm diam, subhyaline to faintly yellowish, interspersed with oleiferous hyphae, 3-4µm diam with refractive contents. Hymenial cystidia absent. Hymenium thickening with the subhymenium a thick ill defined zone. Basidia 4,5,6-spored, 116-128 X 7.3-9µm; sterigmata large, 4-6µm long, and incurved, with the fifth and sixth further from the apex. Basidiospores (Fig.14) (6-)7.5-10(-11.3) X 4.5-5.5µm, av./10 = 8.5 X 4.9µm, L/W 1.72-1.74, ovoid to ellipsoid in face view, slightly inequilateral in profile, smooth, thin-walled, hyaline, nonamyloid. Hyphae in the stipe similar to the tramal hyphae but more clearly aligned vertically. Basal mycelial hyphae smooth, thin-walled, 2.5-4µm. Clamp connections abundant in all tissues.

Habit and Habitat: Solitary to gregarious, often in small clusters , on bare or mossy or grassy needle beds, in second growth spruce (*Picea sitchensis*) without other tree associates, or under spruce (*Picea* spp.) with hemlock (*Tsuga* spp.) and or fir (*Abies* spp.).

Specimens examined and described (all DAOM): Canada: British Columbia: Queen Charlotte Islands, Graham Island, Naikoon Provincial Park, Tow Hill, 20 Sept 1982, SA Redhead (220892), 28 Sept 1982, SAR (220893); Vancouver Island, Pacific Rim National Park, Wickaninnish Bay, N49°03' W125°43', Long Beach, 15 Sept 1995, SAR (220723 [Holotype], 220724, 220725, 220726). **U.S.A.: Washington:** Skamania Co., Gifford Pinchot National Forest, Steamboat Natural Research Area (SE quarter, Sec. 35, T 8N, R 8E, elev. 4,000'), 21 Sept 1996, J Lindgren (220872).

Mr. Campbell (PRNP) led Redhead to the type locality, indicating that both that site and the *C. formosus* site across the highway higher up on the treed dunes were illegally harvested by commercial mushroom poachers seeking both chanterelles and boletes. Later, a discussion with the owner of one of the southeastern Vancouver Island chanterelle buying stations revealed that chanterelles were brought in from across the entire island, and that one form was locally known as the "big yellow one." It seems probable that *C. cibarius* var. *roseocanus* is the larger more conspicuously yellow taxon being brought into the stations along with *C. formosus*. The common name **Rainbow Chanterelle** is suggested. It sports an array of colours, it occurs in rain forests, and at its end it is golden.

Preliminary Field Key to *Cantharellus* subgenus *Cantharellus* from the PNW and BC (excluding California):

1. Basidiomes whitish overall (pallid, ivory, or buff), tardily staining yellowish where handled; apparently associated with Douglas Fir .... ***C. subalbidus***

1. Basidiomes under normal conditions distinctly pigmented with yellow, yellowish pink, yellowish ochraceous, or orangish colours **2**

2. Pilei with a thin persistent but virtually transparent fuscous coloured cuticle, which may or may not form darkened appressed squamules, but often is detectable simply from a slightly grayer tint to the pileus surface which is otherwise yellowish orange to orangish yellow centrally, and sometimes pinkish to nearly white on the very edge; the **hymenium** when normally pigmented (i.e. not fruiting in virtual darkness) **orangish to orangish yellow with a pinkish tinge** especially evident when the basidiomes are not water-soaked, and in more mature specimens **typically paler than the pileus**; when freshly picked and still succulent, i.e. not dried on the surface, all portions readily **staining yellow** and then becoming ochreous; stipe concolourous with the pileus colouration below the fuscous layer, i.e. yellowish orange to orangish yellow; apparently associated with hemlock, pines, and possibly other conifers .... ***C. formosus***

2. Pilei **bright orangish yellow** overall when mature, but when young covered marginally or overall by a **thin pinkish or yellowish pink hoary coating**, lacking a fuscous coating, hence neither developing darkened appressed scales nor showing grayer (sooty) tones when partially dehydrated, although a whitening may be present in undamaged partially drying specimens; hymenium a **rich orangish yellow** generally lacking pinkish tints when mature (normally pinkish tints totally absent), **typically the most intensely yellowish pigmented tissue of the basidiomes**, hence as dark or darker than the pileus after the rosy hoar fades; stipe light to dark orangish yellow; not immediately staining yellow or ochreous,

however exhibiting darkened areas where damaged; stipe concolourous with the pileus, or paler, but lacking the pinkish bloom; apparently associated with spruce, but possibly with other conifers such as hemlock also
. . . . **C. cibarius var. roseocanus**

Cautionary notes: An inadequately characterized form with a pallid pileus, yellow hymenium and stipe is known from Meager Creek in B.C. under poplars mixed with conifers and from Vancouver Island near Port Alberni, under Douglas fir with birch and alder. They may represent *C. pallens*. In California, two taxa have been reported from under Fagaceae, either *Lithocarpus* or *Quercus*. Thiers (1985) reported *Cantharellus cibarius* var. *cibarius* under oaks or related hardwoods, and from Mendocino Co. he described a western form of *C. cibarius* var. *pallidifolius* A.H. Smith, which was previously known from Michigan. Arora (1991, p. 2) published a colour photograph of what may be the latter, amongst either *Lithocarpus* or *Quercus* leaves. States (1990, p. 125) shows yet another form under pines from the Southwestern USA, with a glaucous coating on the pileus, a yellow hymenium, and a yellowish white stipe. All of these may represent independent species.

Microscopical separation of *C. formosus* from *C. cibarius* var. *roseocanus*: Differentiation of dried materials is particularly difficult as specimens of both darken to ochraceous orange, as do some collections of *C. subalbidus* and the suspected *C. pallens*. *Cantharellus formosus* typically has fuscous contents in some of the collapsed cuticular hyphae while *C. cibarius* varieties generally lack them. The determination is subjective and requires comparative materials. The basidiospores of *C. cibarius* var. *roseocanus*, and apparently other close allies of *C. cibarius* are more elongated, often exceeding 10μm in length while *C. formosus* spores rarely exceed 9μm in length. The L/W ratio for *C. formosus* is 1.47-1.6 while that of *C. cibarius* var. *roseocanus* is 1.72-1.74 which is comparable to the 1.77-1.98 ratio in *C. cibarius* var. *cibarius* from Europe (see specimens cited below). Similarly, the basidia of *C. cibarius* var. *roseocanus* tend to be longer, 116-128μm, while those of *C. formosus* are 86-120μm. A combination of all three features may be necessary to separate the two taxa from dried materials lacking detailed field notes, and comparative examination of the related western taxa mentioned above has not been made. Corner (1966) indicated that *C. formosus* had more elongated tramal hyphae than did *C. cibarius*, and therefore was more like C. *odoratus* (Schw.)Fr., an eastern species lacking lamellar folds. However, Thiers (1985) found this character to be less than obvious and our studies indicate that in revived dried materials assessment of this feature is virtually impossible. Therefore, it is not critically assessed here. Taste, always a subjective characteristic, may be more crucial as subtle peppery tastes, characteristic of *C. cibarius*, may have been undetected by Redhead because he has a higher threshold levels before detecting such tastes, as has been determined during other comparative mushroom taste tests. Fries (1821) also seemed to have failed to detect distinctive tastes and odours for *C. cibarius* initially.

Specimens of *C. cibarius* var. *cibarius* examined: England: Hertfordshire, Stevenage, Knebworth Wood, 12 Oct 1958, EM Redhead (DAOM 66606). Finland: Kainuu, Paltamo, Oikarila, Kivesvaara, 26 Sept 1979, T Ulvinen (DAOM 179443). Sweden: v.c. Garpenberg, 29 Aug 1974, RH Petersen (TENN 39771, 39776); Lychsele Lappmark, Tarna Parish, 5 Sept 1974, RHP (TENN 39778), 6 Sept 1974, RHP (TENN 39846); Uppland, Jumkil Parish, 5 Sept 1948, A Melderis (DAOM 64898).

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MYCOTAXON

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RESINICIUM FRIABILE SP.NOV. AND A SURVEY OF THE GENUS RESINICIUM
(BASIDIOMYCOTINA, APHYLLOPHORALES)

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A new species *Resinicium friabile* is described, based on specimens from South America. A re-description of *R. granulare*, originally described from Hawaiian Islands and a key to accepted species in *Resinicium* are proposed.

RESINICIUM Parmasto, Conspectus syst. Corticiacearum: (Tartu) p. 97, 1968. Generic type: *Hydnum bicolor* Alb. & Schwein.:Fr.

BASIDIOME resupinate, closely adnate. HYMENOPHORE grandinioid to hydnoid. SUBICULUM thin. HYPHAL SYSTEM monomitic; hyphae thin-walled or with a slight wall thickening and become somewhat glutinous in KOH, with or without clamp connexions. CYSTIDIA of two kinds 1) halocystidia, with a thin-walled bladder 2) astrocystidia, apically stellatelike encrusted. BASIDIA rather short, approximate 25 µm long, semi pedunculate, with four sterigmata, with or without a clamp connexion. SPORES subcylindrical to ellipsoid, inamyloid, non dextrinoid and acyanophilous.
Superficially similar to *Mycoacia* Donk and *Skvortzovia* Bononi & Hjortstam, but above all separated by the typical, large halocystidia and astrocystidia.

RESINICIUM BICOLOR (Alb. & Schwein.:Fr.) Parmasto, Conspectus syst. Corticiacearum: (Tartu) p. 97, 1968. *Hydnum bicolor* Alb. & Schwein.: Fr. Syst. Mycol. 1:417, 1821. *Hydnum bicolor* Alb. & Schwein. Consp. fung. p. 270, 1805. *Odontia bicolor* (Alb. & Schwein.: Fr.) Quél. Ench. Fung. p.

195, 1886. *Hydnum subtile* Fr. Syst. Mycol. 1:425, 1821. *Kneiffia subgelatinosa* Berk. & Broome in Ann. Mag. Nat. Hist. 14:32, 1875. *Hydnum serratum* Peck in Ann. Rept. New York State Mus. Bull. 50:112, 1897. *Hydnum balsameum* Peck in Bull. New York St. Mus. 75:15, 1904.

A comprehensive description and illustration will be found in Eriksson et al. (1981).

Key to species of *Resinicium*

1. Clamp connexions absent, spores ellipsoid 6-7.5 x 3.5-4.5 µm; Hawaii, Costa Rica and Taiwan..***granulare***
1. Clamp connexions present.. **2**
2. Hymenophore fragile when dried, spores 4-5 x 2-3 µm, halocystidia small 5-8 µm wide, astrocystidia absent. Mainly temperate..***furfuraceum***
2. Not with this combination of character.. **3**
3. Basidiome rather soft, spores narrowly ellipsoid or cylindrical, halocystidia generally 15-20 µm wide, astrocystidia abundant. Cosmopolitan .... ***bicolor***
3. Basidiome mainly brittle, spores ellipsoid, halocystidia 20-30 µm wide, astrocystidia few, spores ellipsoid. Tropical, yet only known with certainty from South America and Hawaii.....................................***friabile***

RESINICIUM FRIABILE Hjortstam & Melo sp. nov.. .... **Fig. 1**
Differt a Resinicio bicolori halocystidiis apicalibus 20-30 µm latis et sporis ellipsoideis 4.5-5.5x 2.8-3(-3.5) µm. Basidioma fragile, uniformiter coloratum.
Holotypus: Brazil, São Paulo, Santos, Ubatuba, Ilha Anchieta, 17-18 Jan. 1987, on wood on the ground, Ryvarden 24159 (K).
Isotypi: (LISU and Hjm privat Herb.).
Paratypi: ditto, Ryvarden 24168; Cananeia, Ilha do Cardoso, 2-5 Jan.1987, on wood, Hjortstam 16770, Ryvarden 24758 and 24874; São Paulo, Pqe Estados das Fontes do Ipiranga, 22 Aug. 1966, B. Skvortzow, SP 95558. Africa, Kenya, Coast Prov., Kwale distr., Shimbia Hills, Makadara Forest, alt. 400 m, 14 Feb., Ryvarden No. 10403 (at least duplicates in K).

BASIDIOME resupinate, closely adnate, somewhat hard and brittle. HYMENOPHORE odontioid, pale brown, aculei 0.5-1 mm long, crowded, smooth or more commonly with small tubercles along the side, margin abrupt or thinning out. HYPHAL SYSTEM monomitic; hyphae with clamp

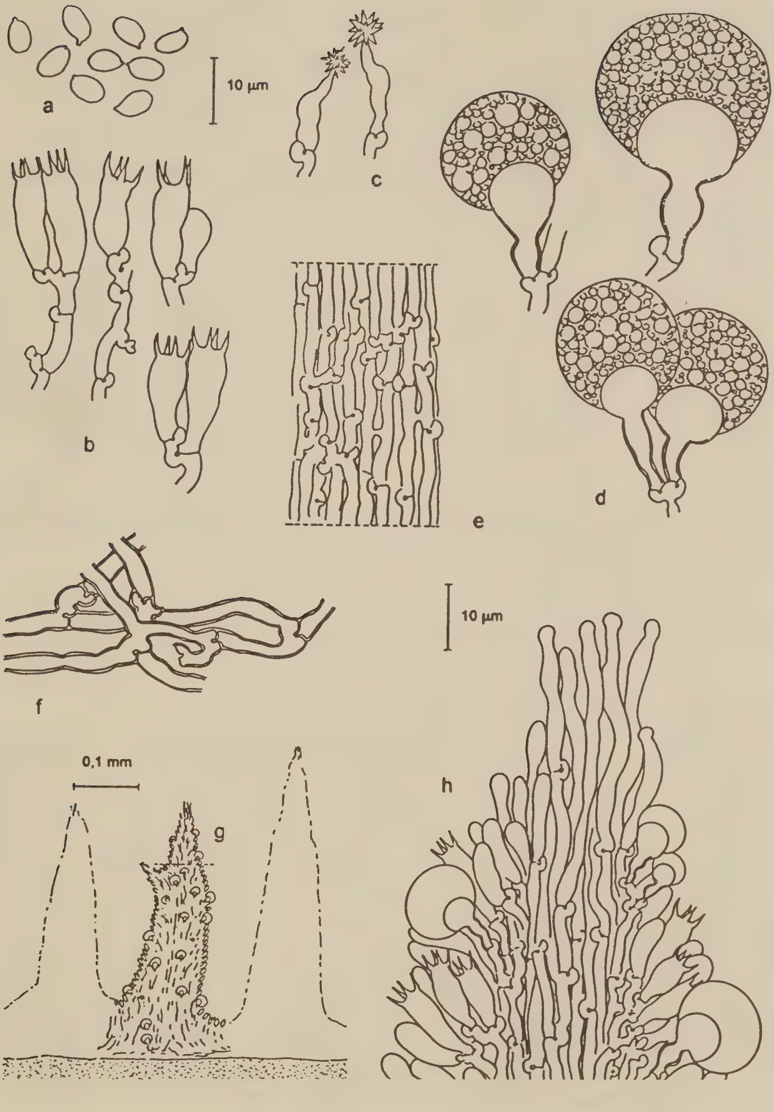

Fig. 1. ***Resinicium friabile*** (holotype). a) spores b) basidia c) astrocystidia d) halocystidia e) hyphae from dissepiment f) basal hyphae g) section through basidiome h) apex of hymenial tooth (del. Melo).

connexions, thin-walled or with slight wall thickening, 2.5-4 µm wide, in the centre of the aculei densely intermingled or parallelly arranged, projecting in the sterile apices of the aculei. CYSTIDIA of two kinds; a) capitate (halocystidia), usually numerous, apical bladder 20-30 µm wide, with oily contents, inner part finely rugose or smooth (KOH); b) astrocystidia few to scattered and sometimes difficult to observe. BASIDIA clavate, indistinctly pedunculate, (15-) 18-20 x 4-4.5 µm, with four sterigmata and a basal clamp connexion. SPORES broadly ellipsoid, 4.5-5 x 2.8-3(-3.5) µm, smooth, thin-walled, with a prominent apiculus.

This species is separated from *Resinicium bicolor* (Alb. & Schwein.:Fr.) Parm. which has subcylindrical spores 5.5-8 x 2.5-3.5 µm, and somewhat narrower halocystidia. The basidiome of *R. friabile* is rather brittle and uniformly coloured, whereas *R. bicolor* is softer, at first whitish then darkening and becoming brownish in patches. Specimens from tropical areas should be re-examined and some maybe are independent or belong to *R. friabile*.

Mycoaciella bispora (Stalpers) J. Erikss. & Ryvarden, Corticiaceae North Eur. 5: 902, 1978. *Resinicium bisporum* Stalpers in Persoonia 9:145, 1976. Accepted in *Mycoaciella*.

Resinicium granulare (Burt) Sheng H. Wu in Acta Bot. Fennica 142:35, 1990. *Corticium granulare* Burt in Ann. Mo. Bot. Gard. 10:187, 1923. .... **Fig. 2**

Brief description based on the specimen below.

BASIDIOME resupinate, soft, closely adnate. HYMENOPHORE whitish or more or less cream-coloured, grandinioid to odontioid, in younger parts more or less smooth or pruinose, aculei small, almost smooth, 7-10/mm. HYPHAL SYSTEM monomotic; hyphae thin-walled, 1.5-3 µm wide, densely septate but without clamp connexions, subiculum thin but rather dense. CYSTIDIA of two kinds; 1) astrocystidia thin-walled, 25-40 (-50) µm long and about 4 µm wide in the lower part, apically often subcapitate, with a stellatelike incrustation; 2) halocystidia capitate, the apical bladder 15-25 µm wide, with oily contents, inner part with thickened wall, capitate, smooth or seemingly with a finely rugose wall (KOH), 15-20 µm long. BASIDIA short-cylindric, usually with a median constriction, 15-20 x 4-5 µm, with four sterigmata and without a basal clamp connexion. SPORES ellipsoid, smooth, thin-walled, 6-7.5 x 3.5-4.5 µm, inamyloid.

Resinicium granulare (*Corticium granulare*) was originally described from a single specimen on herbaceous plant. Liberta (1969) placed it in synonymy with *Odontia bicolor* (*Resinicium bicolor*). Later, Wu (1990) reported it

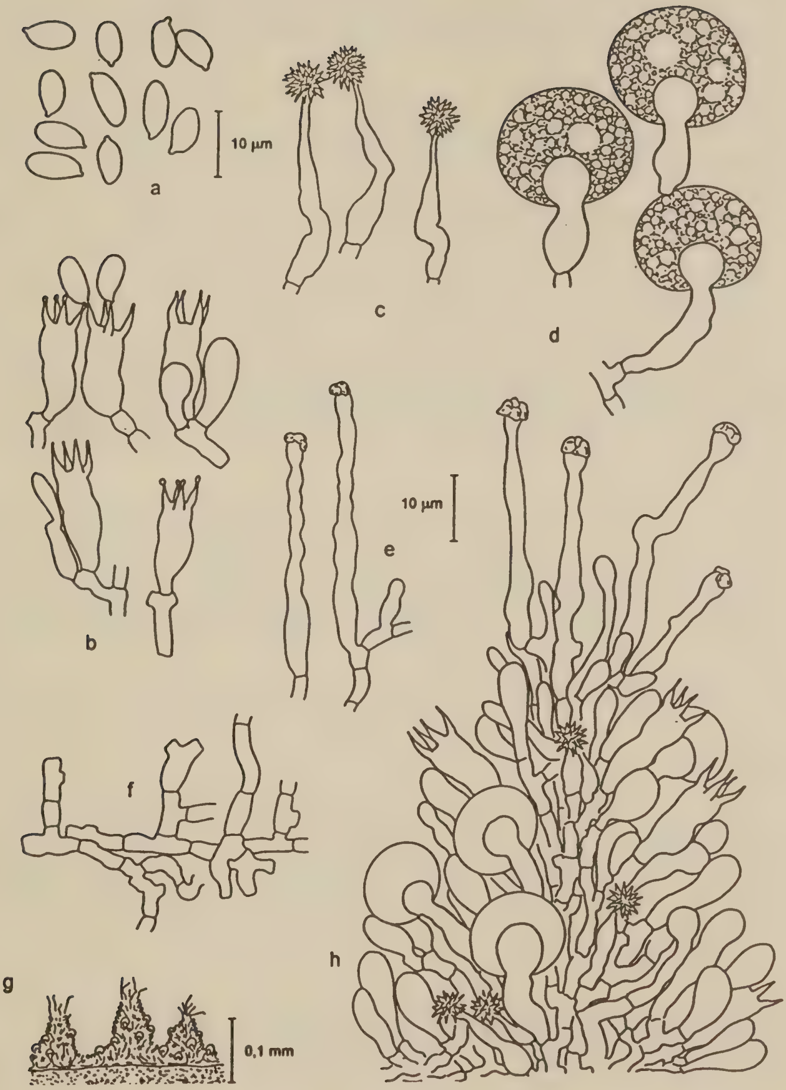

Fig. 2. ***Resinicium granulare*** (Ryvarden 29614). a) spores b) basidia c) astrocystidia d) halocystidia e) terminal hyphae of aculeus f) section through basidiome h) section through basidiome (del. Melo).

from Taiwan (on Poaceae) and provided a description. Apparently the third specimen collected was made by Ryvarden in Costa Rica, Heredia, on *Musa*, No. 29614 (K, GB, LISU).

This species should be easy to recognize by the lack of clamp connexions and with the astrocystidia more elongated than in the two other accepted species. Further, the spores are slightly larger than in *R. friabile*.

Phlebia chiricahuaensis (Gilb. & Budington) Sheng H. Wu in Acta Bot. Fenn. 142: 34, 1990. *Resinicium chiricahuaensis* Gilb. & Budington in Mycologia 62:675, 1970.

Accepted in *Phlebia* s.l., but a thorough investigation of the genus is needed.

Resinicium furfuraceum (Bres.) Parmasto, Conspectus syst. Corticiacearum: (Tartu) p. 98, 1968. *Corticium furfuraceum* Bres. in Mycologia 17: 69, 1925. *Corticium subpallidulum* Litsch. in Svensk Bot. Tidskr. 32:284, 1938.

This is a well known species on coniferous wood and its main distribution is temperate though also reported from Florida by Ginns & Lefebvre (1993) and from Venezuela by Liberta & Navas (1978). Superficially this species is somewhat reminiscent of *Resinicium*, by virtue of the abundant cystidia which are provided with a small halo. The latter are considerably smaller than for other species in the genus.

There is a good description and illustration of *R. furfuraceum* by Eriksson et al. (1981) apart from the basidia and spores. For the time being we accept this species in *Resinicium*.

Skvortzovia furfurella (Bres.) Bononi & Hjortstam in Mycotaxon 28:12, 1987. *Odontia furfurella* Bres. in Mycologia 17:71, 1925. *Resinicium furfurellum* (Bres.) Nakasone in Mycol. Mem. 15:284, 1990. *Jacksonomyces furfurellus* (Bres.) Sheng H. Wu & Z.C. Chen in Bull. Nat. Mus. Nat. Sci. 3:262, 1992.

Accepted in *Skvortzovia*.

Phlebia lutea (Jülich) Sheng H. Wu in Acta Bot. Fenn. 142:34, 1990.
Resinicium luteum Jülich in Persoonia 9:468, 1978.

This species was originally described from Australia, but also occurs in Brazil. *Resinicium luteum* differs from other species of *Resinicium* by the lack of encrusted cystidia (astrocystidia) and the other kind of cystidia are not real halocystidia, and such cystidia can also be found in both *Mycoacia* and *Mycoaciella*. For the time being we maintain the species in *Phlebia* s.l.

Mycoacia meridionalis Burds. & Nakasone in Mycologia 73:465, 1981. *Resinicium meridionale* (Burds. & Nakasone.) Nakasone in Mycol. Mem. 15:285, 1990.
Accepted in *Mycoacia.*

Mycoacia pinicola J. Erikss. in Svensk Bot. Tidskr. 43:59, 1949. *Resinicium pinicola* (J. Erikss.) J. Erikss. & Hjortstam, Corticiaceae North Eur. 6:1271, 1981.
Accepted in *Mycoacia.*

Corticium praeteritum H.S. Jacks. & Dearden in Can. J. Res. C 27:152, 1949. *Resinicium praeteritum* (H.S. Jacks. & Dearden) Ginns & Lefebvre in Mycol. Mem. 19:138 1993.
Known only from the type and of uncertain position. It is, however, evident from the original description and illustration that this species does not belong in *Resinicum.*

ACKNOWLEDGMENT

The authors are grateful to Prof. David Pegler and Mr. Peter Roberts, Royal Botanic Gardens, Kew for critically reviewing the manuscript and for valuable criticism.

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MYCOTAXON

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ARGENTINOMYCES NAVICULISPORIS GEN. ET SP. NOV., A NEW MARINE LIGNICOLOUS ASCOMYCETE FROM MAR DEL PLATA, ARGENTINA.

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A new genus **Argentinomyces** with a single species, **A. naviculisporis**, is described from driftwood in Mar del Plata (Argentina). This is the first new genus and species of marine fungi reported from Argentina.

INTRODUCTION

During our study of the lignicolous marine fungi from Mar del Plata, Buenos Aires province, Argentina, since 1992 two papers have been published listing 22 species, 6 are new records for Argentina and 7 new records for South America (Peña et al., 1996; Peña & Arambarri, 1996).

In this paper we describe a new genus, this species cannot be assigned to any of the existing genera. The new genus **Argentinomyces**, based on **A. naviculisporis**, is characterized by ellipsoidal or small ship-shaped 0-3 septate ascospores without sheaths or appendages; unitunicate, persistent asci without apical apparatus and with a thick walled apex and small membranous ascocarps without paraphyses immersed in the substratum.

MATERIALS AND METHODOS

Driftwood was collected only from the type locality, Mar del Plata, Buenos Aires province, Argentina. Collected material was kept in a plastic bag and frozen at -4°C for a week. Therafter, light microphotographs were taken and camera lucida drawings made. Then it was preserved in formaline-glycerine-seawater. Ascomata (from the preserved material) were sectioned on a Cryostat. The holotype has been deposited in the herbarium of the Instituto Spegazzini, La Plata, Argentina (LPS).

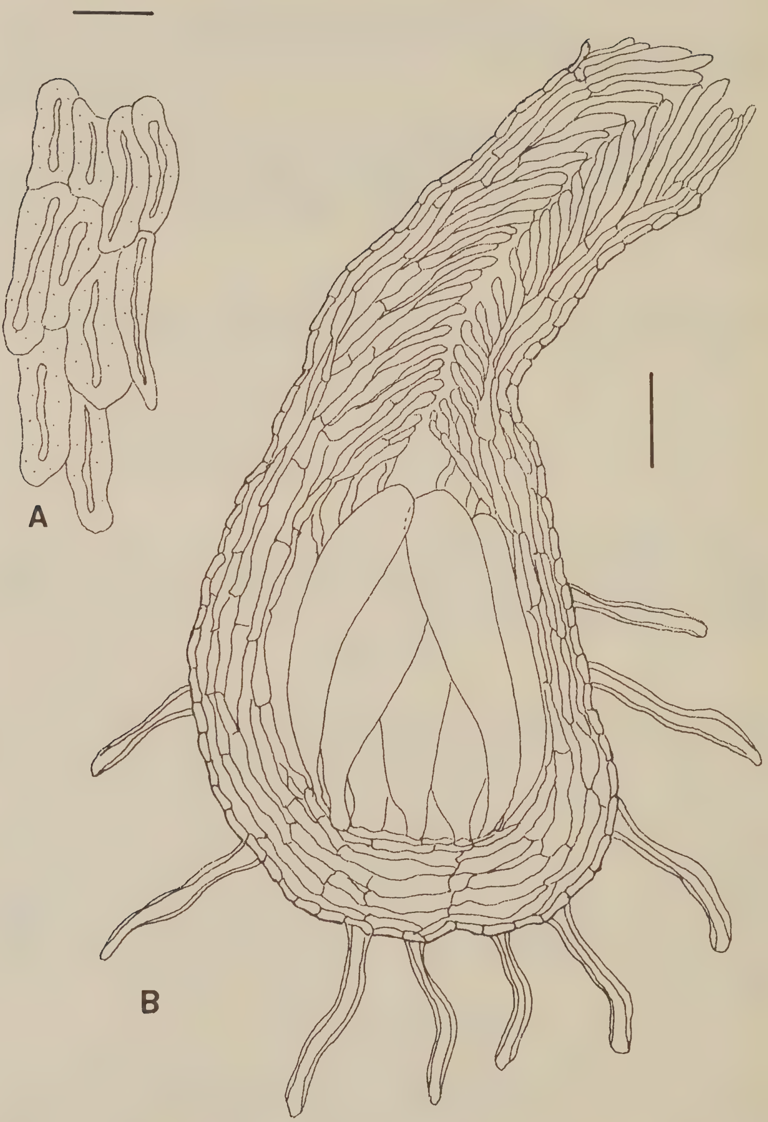


Fig. 1.**Argentinomyces naviculisporis**. A. Section through the peridium (scale = 5 μm). B. Ascocarp, longitudinal section (scale = 20 μm).

TAXONOMY

Argentinomyces Peña & Arambarri gen. nov.

Ascocarpii subglobosi, in ligno immersi, ostiolati, papillati, periphysati, membranacea, cremea, solitarii vel interdum gregarii. *Peridium* paquidermis. *Paraphyses* absentes. *Hamathecial tissue* absent. *Asci* octospori, clavati, breve pedunculati, unitunicati, leptodermi, cum apice incrassatuto sine apparato apicali, persistenti, ex base ascocarporum muri evolventes. *Ascosporae* ellipsoideis ad naviculiformis, 0-3 septatis, ad septa haud vel leniter constrictae, hyalinis, sine tegmentis gelatinosis vel appendicibus.

Ascomata subglobose, immersed, ostiolate, papillate, periphysate, membranous, cream-coloured, solitary sometimes gregarious. *Peridium* thick. *Paraphyses* absent. *Asci* eight-spored, clavate, short pedunculate, unitunicate, thin-walled, thick-walled apex, without apical apparatus, persistent, developing from ascogenous tissue lining the base. *Ascospores* ellipsoid or small ship-shape, 0-3 septate, slightly constricted at the septa or not, hyaline, without sheaths or appendages.

Type species **Argentinomyces naviculisporis** Peña et Arambarri.

Etymology: From the latinized name of the country of origin of the type collection.

Argentinomyces navisculisporis Peña & Arambarri. sp. nov. (Figs.1-3).

Ascocarpii 200-340 µm longis, 113-280 µm diametro, subglobosi, in ligno immersi, ostiolati, papillati, membranacea, cremea, solitarii vel interdum gregarii, hyphis circumdatis; collis 78-172,5 µm longis, 34-50,5 µm diametro, periphysati. *Peridium* 10-20 µm crassum, 6-10 stratum. *Paraphyses* absentes. *Asci* 77-113,5 x 15.4-35 µm, octospori, clavati, breve pedunculati, unitunicati, leptodermis, cum apice incerssatuto sine apparato apicali, persistenti. *Ascosporis* (25-) 30-35 (-40) x (6-) 8-10 (-14) µm (x=31,14 x 8,54 µm; n=60), ellipsoideis ad naviculiformis, 0-3 septatis, ad septa haud vel liniter constrictae, interdum curvatis, hyalinis, sine tegmentis gelatinosis vel appendicibus, multis gutulis.

Ascomata 200-340 µm long, 113-280 µm in diameter, subglobose, immersed, ostiolate, papillate, periphysate, membranous, cream-coloured, solitary sometimes gregarious, surrounded by hyphae. *Necks* 78-172,5 µm long, 34-50,5 µm wide. *Peridium* 10-20 µm thick, composed of 6-10 layers of cells, with textura oblita. *Paraphyses* absent. *Hamathecial tissue* absent. *Asci* 77-113,5 x 15,4-35 µm, eight-spored, clavate, short pedunculate, unitunicate, thin-walled, thick walled apex, without apical apparatuse, persistent. *Ascospores* (25-) 30-35 (-

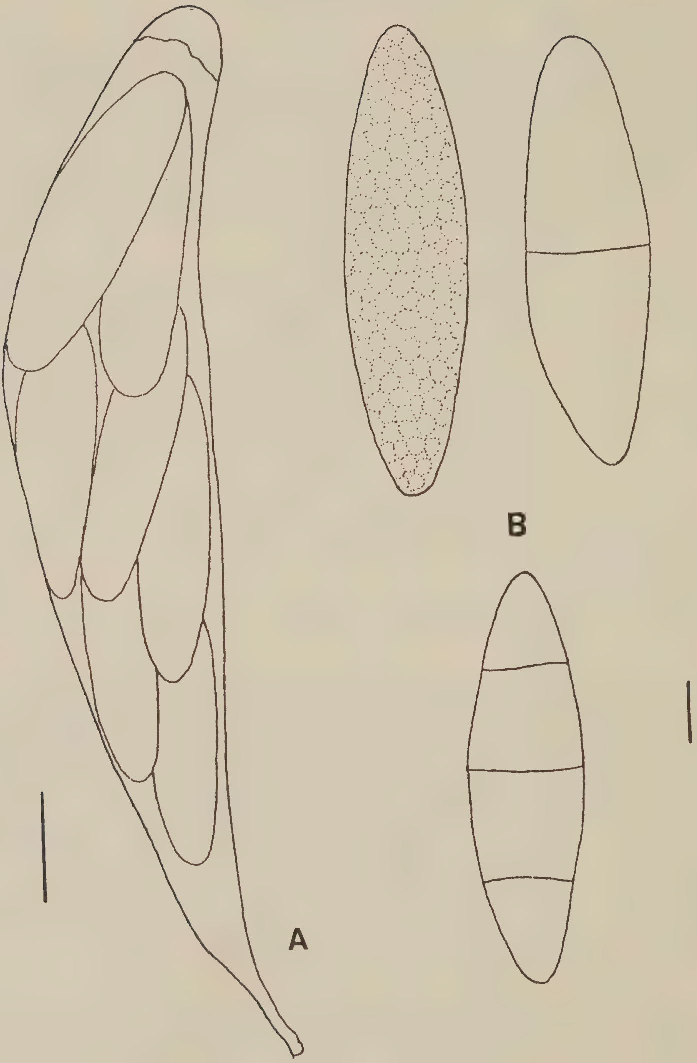


Fig. 2. **Argentinomyces naviculisporis.** A. Ascus with thick walled apex (scale = 10 µm). B. Ascospores; multigutulate one-celled, bi-celled or four-celled (scale = 5 µm).

40) x (6-) 8-10 (-14) µm (x=31,14 x 8,54 µm; n=60) ellipsoid or small ship-shape, 0-3 septate, slightly constricted at the septa or not, some times more or less curved, hyaline, without sheaths or appendages, multigutulate.

Etymology: From the Latin, *navis* = small ship and *spora* = spore, in reference to the small ship-shape of the ascospore.

Substrate: Driftwood.

Range: Atlantic Ocean, known only from the type locality, Mar del Plata, Buenos Aires province, Argentina.

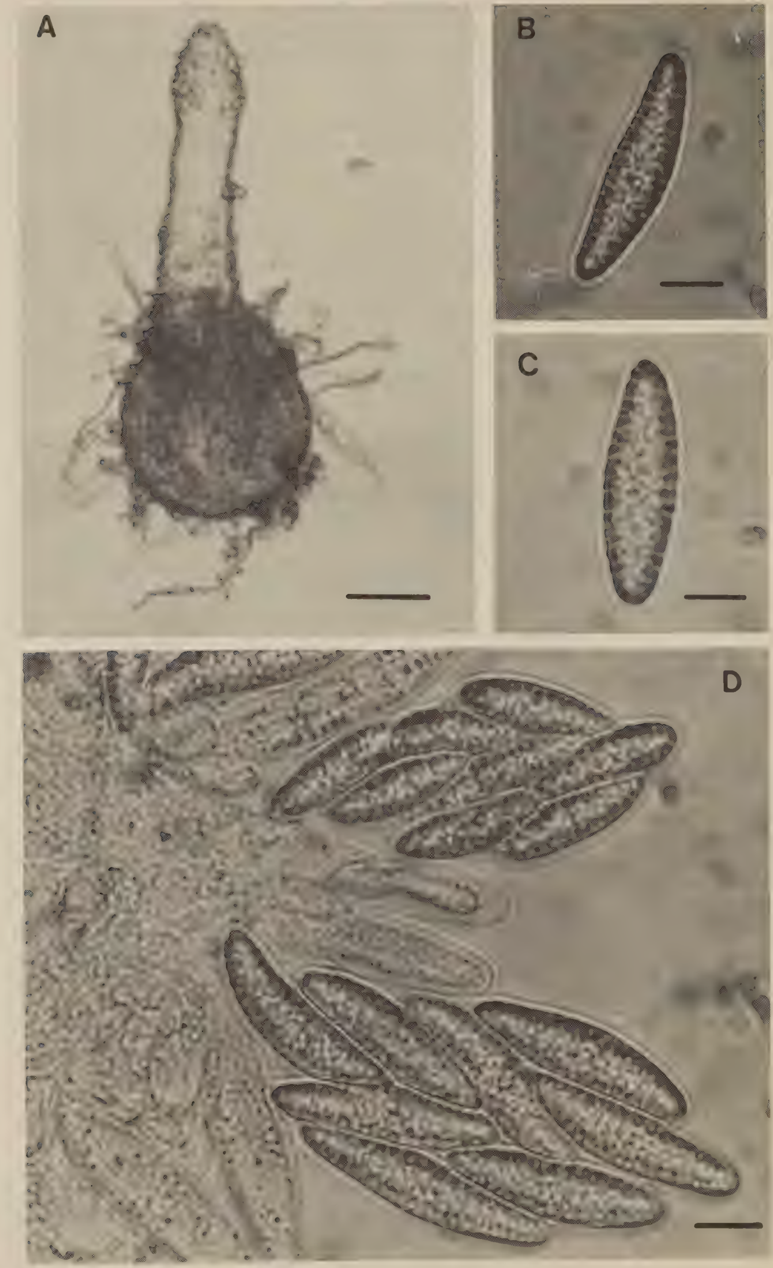
Material examined: Driftwood, Mar del Plata, Buenos Aires province, Argentina, 38° 08′ S, 57° 32′ W, leg. Peña & Arambarri, 13 July 1996. *Holotype*: liquid-preserved material, LPS 45469 and permanent slides from the particular author's collection.

DISCUSSION

Argentinomyces cannot be assigned to any family of the Ascomycota with any certainty, althouth it has affinities with the ascomata of the Halosphaeriaceae. At first glance it seems to be a member of Halosphaeriaceae by hyaline, membranous perithecial ascomata without paraphyses or any interascal tissue and hyaline ascospores. However the persistent asci with thick walled apex are characteristics inconsistent with members of this family (Barr, 1990; Hawksworth et al., 1995; Jones, 1995). **Rhizophila** Hyde & Jones is the genus that most resembles **Argentinomyces.** Both have immersed, periphysate ascocarps; the asci are 8-spored, clavate, pedunculate, unitunicate, thin-walled with an apical thickening, without apical apparatus and the shape of the ascospores is very similar, but differs in many characterictics. **Rhizophila** has coriaceous, dark brown to black ascomata with paraphyses-like structures and asci developing from ascogenous tissue lining the cavity of the ascomata, nevertheless **Argentinomyces** has membranous, cream-coloured ascomata without paraphyses and asci developing only from ascogenous tissue lining the base of the ascocarps wall. **Rhizophila** has ellipsoidal or fusiform, one-celled, yellowish to yellowish brown ascospores, while **Argentinomyces** has ellipsoidal or small ship-shape, 0-3 septate, slightly constricted at the septa, hyaline ascospores.

For the reasons outlined above a new genus is erected for this species and assigned to the Ascomycota incertae sedis.

Fig. 3. **Argentinomyces naviculisporis**. A. Ascoma with long neck (scale = 50 µm). B-C. Ascospores (scale = 10 µm). D. Mature thin-walled asci with ascospores. Thick walled apical region of a young ascus arrowed (scale = 10 µm).


A
B
C
D

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WEGEA, A NEW GENUS OF NON-LICHENIZED, CALICIOID ASCOMYCETES IN THE ARTHONIALES.

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ABSTRACT

The new monotypic non-lichenized ascomycete genus *Wegea* with the species *W. tylophorelloides* is described. It belongs to the Arthoniales and in its gross morphology recalls that of calicioid fungi. It does not, however, form a mazaedium. The ontogeny of the ornamented spores is described.

INTRODUCTION

During the Benelux lichenological expedition to Papua New Guinea in 1992, a logging area in a virgin lowland rain forest situated on the foothills of the Finisterre Range was visited. The locality was very rich in corticolous lichens, and is the only known locality of the monotypic genus *Melanophloea* P. James & Vezda (Aptroot & al. 1997) in Papua-New Guinea. On the upper part of the trunk of one of the felled trees an unusual and to us unknown non-lichenized, calicioid ascomycete occurred. It had a characteristic purple pigmentation, stalked ascomata, septate, ornamented spores and asci similar to those of Arthoniales. As the species in our opinion cannot be accommodated in any established genus, a new genus is also described.

MATERIAL AND METHODS

For SEM, dry material was mounted on specimen stubs and coated with gold. For transmission electron microscopy, small pieces of material were fixed in 2.5% glutaraldehyde buffered with sodium cacodylate at pH 7.2, post-fixed in 2% osmium tetroxide at 4°C for two hours, embedded in Epon and sectioned and double-stained with lead citrate and uranyl acetate.

RESULTS

Wegea tylophorelloides Aptroot & Tibell gen. et spec. nov.

Thallus immersus, non lichenisatus. Ascomata breviter stipitata, capitulo sphaerico, sine mazaedio. Hamathecium hyphis angustis anastomosantibus ramosisque formatum, I+ flavofuscum, KI+ atrocyaneum. Asci clavati, pariete valde crasso et loculo oculari distincto, I-. Ascosporae 3-septatae, leviter asymmetricae, postremo atrofuscae, pariete distincte ruguloso.

Etymology. The genus is named in honor of the eminent mycologist Walter Gams. The specific epithet indicates a similarity to *Tylophorella.*

Thallus grayish white, immersed in the bark, with a narrow black or more effuse, dark reddish prothallus (Fig. 1). No photobiont. Ascomata short-stalked, 0.26-0.34 mm high, with a widened, subspherical capitulum (Fig. 2). Capitulum matt grayish to reddish brown, with uneven surface, 0.18-0.24 mm diam. Stalk short, black, smooth, 0.12-0.14 mm diam. In the lower part the stalk consists of strongly intertwined, hyaline hyphae, 5-8 µm diam., with heavily gelatinized walls and a very narrow lumina. Upper part of stalk strongly inspersed with irregular, reddish pigment crystals. In the uppermost parts the hyphae are radially arranged and form a poorly differentiated excipulum of strongly sclerotized and pigment-inspersed hyphae. Hypothecium convex. Red-pigmented parts of the ascomata K+ blackish aeruginose. Stalk I+ violet red, KI+ pale blue. Hamathecium formed by narrow, anastomosing and branched hyphae, c. 1 µm diam. Hamathecium I+ yellowish brown, KI+ dark blue. Asci clavate, 29-34 x 9-12 µm, particularly in young asci with strongly thickened, multi-layered wall in the upper part and distinct ocular chamber, I-, K/I-. Ascospores 3-septate, 12-18 x 4-6 µm, slightly

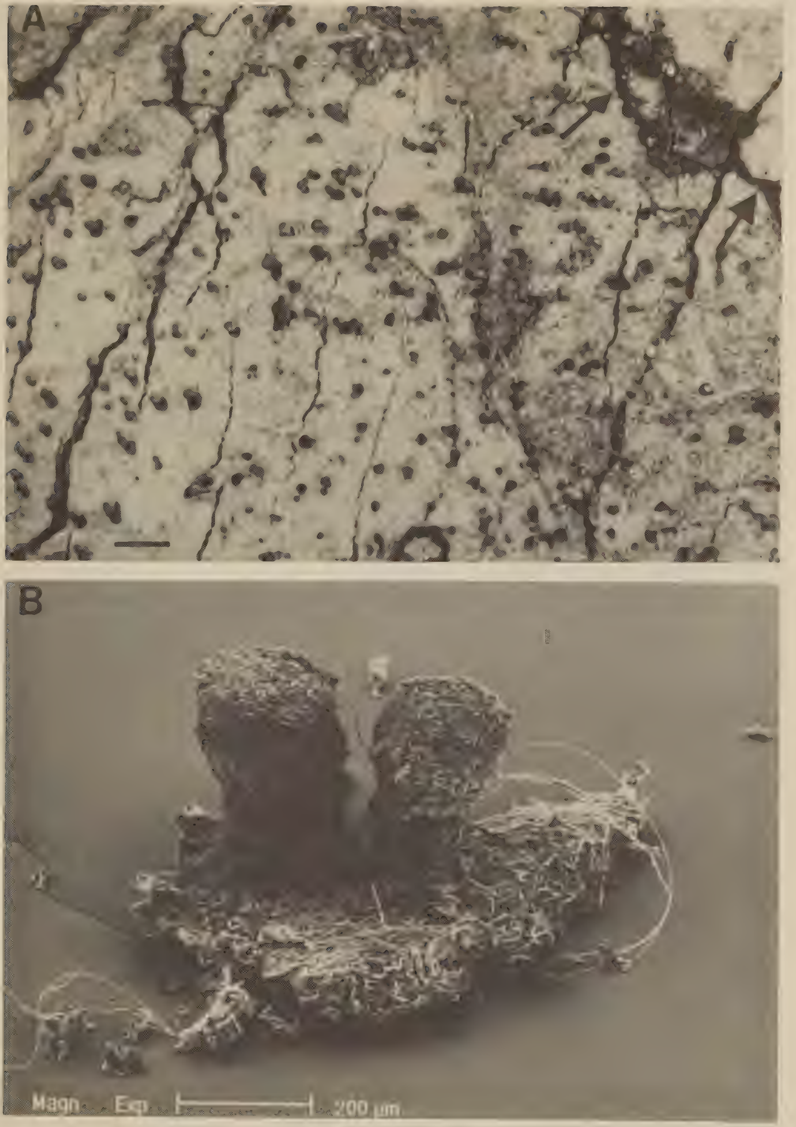


Fig. 1. *Wegea tylophorelloides*. A. Numerous ascomata and distinct prothallus (arrows). B. Two mature ascomata. - Isotype (UPS). Scales: A= 1 mm, B= 200 µm.

asymmetric, hyaline. Mature spores dark brown, with a distinctive dark brown ornamentation. Septa and proper wall of the spores, however, remaining hyaline. Conidiomata not found.

Chemistry: No substances found by TLC. The reddish pigment not soluble in acetone.

Type: Papua-New Guinea. Madang Prov., foothills of the Finisterre Range, along the road between Madang and Lae, 145°34'E, 5°25'S. Alt. c. 230 m. In rain forest on low hills. 14.VII.1992 Aptroot 33330 (CBS, holotype; ABL, B, LG, UPS, isotypes).

An extensive occurrence of this species was found on a felled tree in a lowland rainforest. In 1995 the same locality was visited again, and the characteristic ascospores were found on some other lichens, but no thalli were then observed.

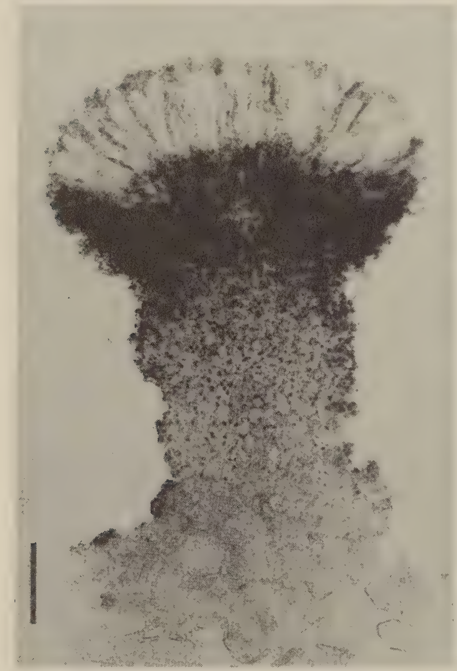


Fig. 2. *Wegea tylophorelloides*. Section of mature ascoma. - Isotype (UPS). Scale: 50 µm.

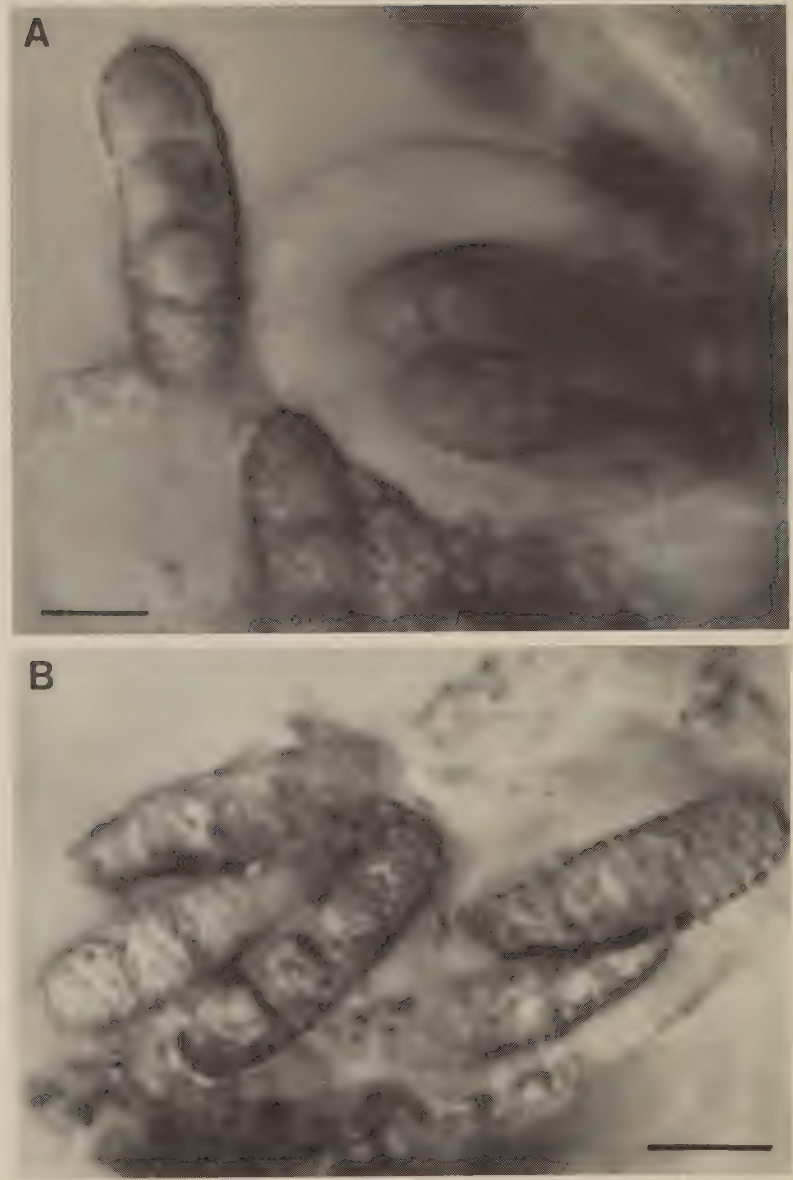
Ascus structure.

The clavate asci of *Wegea* are strongly thickened in the apical part, and have a distinct ocular chamber (Figs 3A, 4A). The c-layer is rather thick. The apically very strongly thickened d-layer (Letrouit-Galinou et al. 1994) is distinctly layered, but a differentiation of the d-layer into a d_1- and d_2-layer as in some other Arthoniales was not observed.

Spore ontogeny.
The spores have an ornamentation clearly noticeable under the light microscope (Fig. 3B). Viewed by the SEM they display a very elaborate surface pattern, where the outermost layer forms loosely interconnected, irregular areas with rounded edges (Fig. 7). As seen under the TEM young spores in the asci have thin, non-pigmented, irregularly folding walls, but develop a slight stratification at slightly later stages in connection with septum formation (Fig. 5). In semi-mature spores a differentiation of the spore wall is visible. The spore is enclosed by a strongly undulating double membrane, and the thin perispore is supported by a massive, electron-lucent proper wall (Fig. 6A). In the innermost part of the perispore a very thin pigment layer is formed delineating the proper wall. The perispore contains numerous large vesicles, but also in the outer part irregular accumulations of melanized material. (Fig. 6A). These accumulations expand and become partly connected. They are also loosely connected with the melanized layer of the innermost part of the perispore (Fig. 6B). The electron-lucent parts of the perispore break down and the melanized material is left as an intricate ornamentation on the surface, where the outer melanized layer often is separated from the inner melanized layer by an electron-lucent boundary (Fig. 4B). The outermost layer is incomplete and thus allows the innermost layer to be observed also on the SEM pictures (Fig. 7B).

DISCUSSION

Calicioid lichenized and non-lichenized fungi are known to form a very diverse assemblage (Tibell 1984) and belong to widely different orders among the ascomycetes. Thus based on 18S SSU rDNA data Sphaerophoraceae and Caliciaceae have been shown to belong to the Lecanorales (Wedin et al., 1997, Wedin & Tibell, 1997) and Mycocaliciaceae and Sphinctrinaceae form a clade with Eurotiales (Wedin & Tibell, 1997). Morphological evidence led to the inclusion of *Pyrgillus* in the Pyrenulales (Tibell 1984, Harris 1989, Aptroot 1991) and *Nadvornikia* in the Ostropales (Tibell 1984, Harris 1990).


A
B

The calicioid lichenized genus *Tylophorella* was shown to be quite similar to Arthoniales (Egea & Tibell, 1993), but seems to lack the iodine reaction typical of most Arthoniales.

Ascus structure has been an essential feature for delimiting Arthoniales, but Letrouit-Galinou & al. (1994) have shown that ascus structure in Arthoniales is quite diverse, particularly with respect to the development of the d-layer of the ascus wall. The ascus of *Wegea* is similar to that of *Arthonia radiata* (Pers.) Ach. as described by Letrouit-Galinou & al (1994). As in *Arthonia radiata* in *Wegea* the asci are broadly clavate, have an ocular chamber, and the d-layer is strongly thickened in the apical part. There is, however, no K/I+ blue ring structure at the ocular chamber in *Wegea*.

Brown-pigmented and ornamented spores occur in Arthoniales, and particularly ageing spores in some species of *Opegrapha* and *Arthonia* show an ornamentation which at the light microscopy level is quite similar to that of *Wegea*. Such spores in Arthoniales, however, have not been investigated in detail.

Letrouit-Galinou & al (1994) investigated the spore ontogeny of several members of the Arthoniales. Their study was, however, based on Thiéry stained material. They showed that the perispore is quite different in different species of Arthoniales, but a well-developed, vesicular perispore is often present. An ornamentation depending on the uneven development of the perispore was described for example in *Opegrapha varia* Pers. and *Arthonia radiata* (Pers.) Ach. A vesicular perispore was also observed in *Wegea*, but that may be due to a different staining technique.

The spores of *Tylophorella pyrenocarpoides* have been studied in some detail (Tibell 1984, Egea & Tibell 1993). They are also elongated, transversely septate and finally dark brown. They differ, however, in having several transverse septa and also develop longitudinal septa. At a late stage in their development, the spores of *Tylophorella* fragment into unicellular pieces, and these spore fragments accumulate in a mazaedium and function as the diaspores of the species. The early stages of spore ontogeny are quite similar in *Tylophorella* (Tibell 1984, Fig. 26B) and *Wegea*,

Fig. 3. *Wegea tylophorelloides*. A. Mature ascus with thickened apex. B. Ascospores released from an ascus. Note their distinctive ornamentation. - Holotype. Scales: A, B= 5 µm

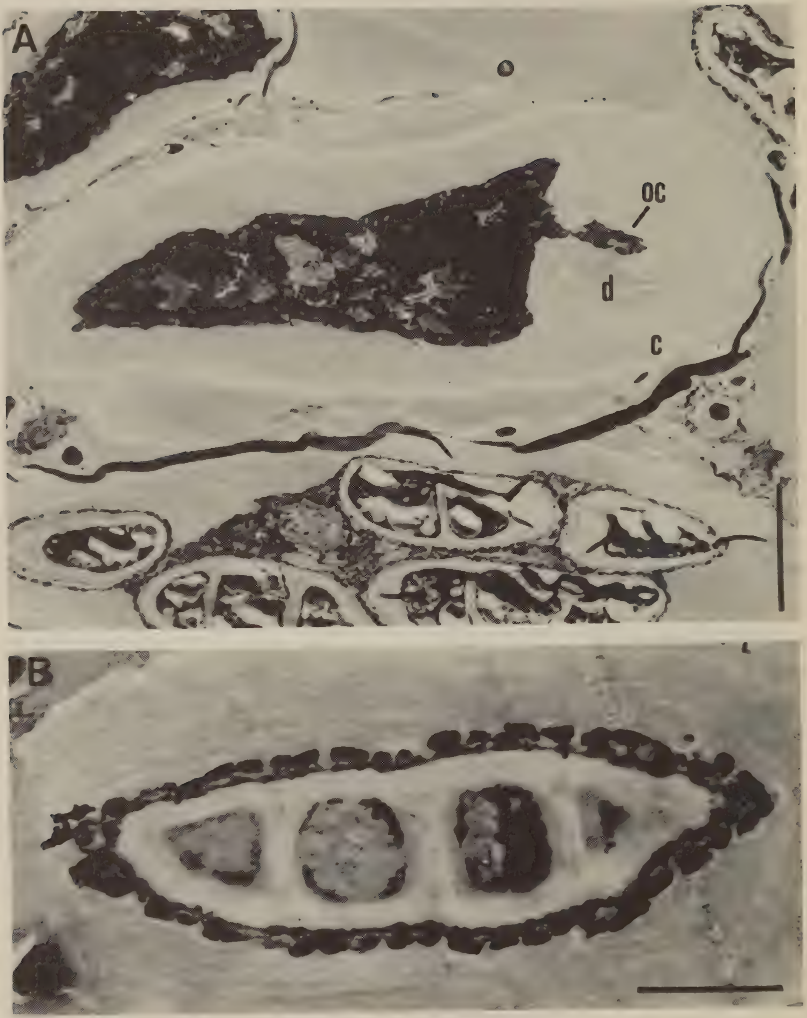


Fig. 4. *Wegea tylophorelloides*. A. Young and semimature ascus. Note strongly thickened apical part and ocular chamber (oc). B. Mature ascospore. c= c-layer of ascus wall, d= d-layer of ascus wall. - Isotype (UPS). Scales: A= 5 µm, B= 3 µm.

but beyond the 3-septate stage the spores of *Tylophorella* develop in a different way. Except for the septation and eventual breakdown of the spores in *Tylophorella*, it also differs in the melanization process and the ontogeny of the ornamentation. The melanization in *Tylophorella* takes place in the proper spore wall, and the septa of the spores also become pigmented. This is not the case in *Wegea*. In *Tylophorella* the pigmentation is first seen as scattered, spherical granules, which eventually become concentrated in the outer part of the spore wall and coalesce loosely to form an irregular ornamentation of the spore fragments (see Tibell 1984, Fig. 26D-F).

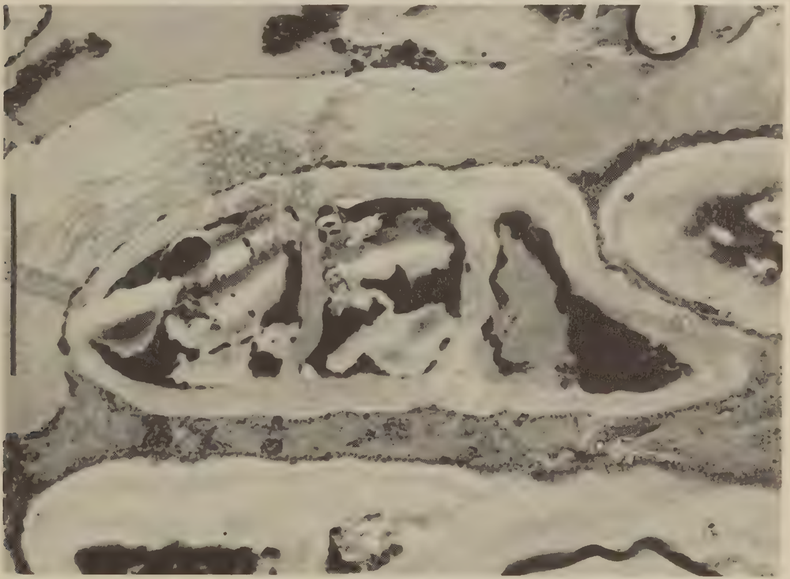


Fig. 5. *Wegea tylophorelloides*. Young ascospores with homogeneous and irregular wall. - Isotype (UPS). Scale = 2 µm.

Wegea shares many features with the Arthoniales; the ascomata are poorly differentiated, stromatic; the spores are ellipsoidal and septate and slightly asymmetric; and the ascus structure and iodine reactions of the hamathecium and vegetative tissues are similar to those of many Arthoniales.

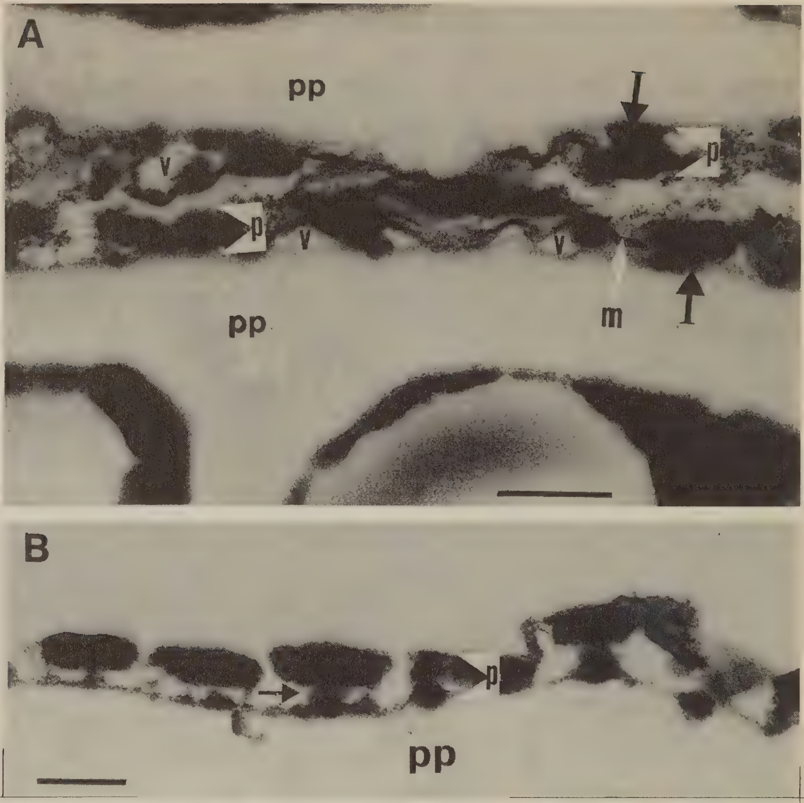
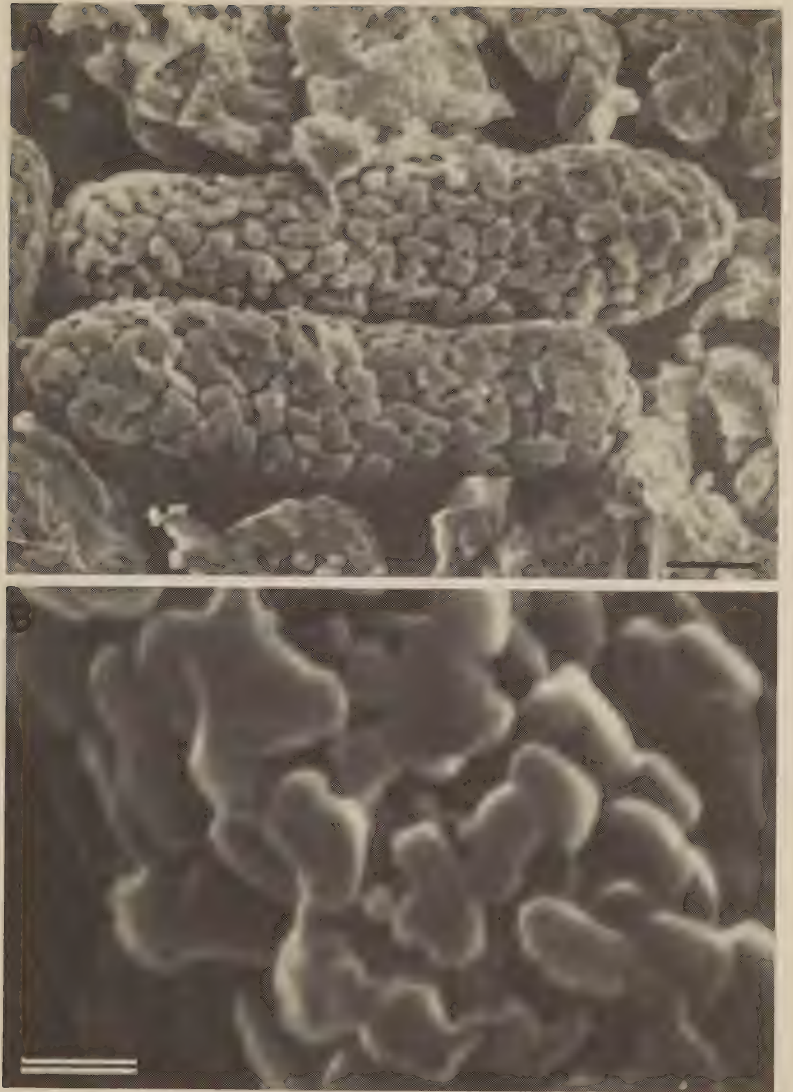


Fig. 6. *Wegea tylophorelloides*. A. Spore walls of two adjacent semi-mature ascospores differentiated into perispore (p) and proper wall (pp). The perispore is delimited by a double membrane (m) and contains vesicles (v) and melanized aggregates (black arrows). B. Detail of spore wall of slightly older spore. Note the deposition of melanized material on the surface of the proper spore wall and the connection (arrow) between this and the melanized aggregates of the outer part of the perispore. - Isotype (UPS). Scales: A, B= 0.3 µm.

Fig. 7. *Wegea tylophorelloides*. A. Mature spore. B. Detail of spore ornamentation. - Isotype (UPS). Scales: A= 2 µm, B= 0.5 µm.


A
B

Wegea in many respects is similar to *Tylophorella*, and it is here likewise suggested to belong to Arthoniales. Like *Tylophorella* it has clavate, apically strongly thickened asci which are I-, the hamathecium consists of branched, anastomosing hyphae and the spores are dark brown, septate and with a distinctive ornamentation. *Wegea* differs however, from *Tylophorella*, in not being lichenized, in having short-stalked ascomata, in containing a reddish pigment and in ascospore ontogeny. The ascospores of *Tylophorella* at an early stage are 3-septate, but in mature spores more transverse and some longitudinal septa are formed and eventually the spores disintegrate into the component cells, whereas in *Wegea* the spores remain 3-septate.

Wegea thus displays calicioid features such as stalked ascomata and pigmented and ornamented spores, but other traits of calicioid fungi such as a well-developed mazaedium and passive spore dispersal are not at hand.

ACKNOWLEDGEMENTS

Dr. G. Thor (Uppsala) is thanked for helpful comments on the manuscript. Ms K. Ryman (Uppsala) supported us with excellent technical assistance. Ms U.-B. Sahlström is thanked for having skilfully produced the prints for the illustrations. The electron microscope work was carried out in cooperation with the Unit for Biological Structure Analysis of the University of Uppsala. Ms A. Axén embedded and sectioned the material for the transmission electron microscope studies. A. Nordin translated the diagnosis into Latin. The Swedish Natural Science Council supplied funds for the work within the project "Taxonomy of Caliciales". Dr. B. Coppins, Royal Botanic Garden, Edinburgh, kindly provided a prepublication review of the paper.

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AN ANNOTATED LIST OF THE APHYLLOPHORALES OF THE BALEARIC ISLANDS*

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Abstract

The present catalogue of the resupinate non poroid Aphyllophorales (Corticiaceae *s.l.*) and poroid Aphyllophorales (Polyporaceae *s.l.*) of the Balearic Islands is based on original data with additions from the bibliography. The better studied areas are the islands of Mallorca and Menorca –which cover ca. 86.6% of the Balearic territory– the scarce data from Ibiza, Cabrera and islets proceed from the literature; only two records are known from Formentera. In all, 176 taxa are listed, 62 of which are new to the archipelago. *Fomitiporia erecta* (David et al.) Fiasson, *Parmastomyces transmutans* (Overh.) Ryvarden & Gilb., *Peniophora boidinii* Reid, *Peniophora rufomarginata* (Pers.) Litsch. and *Phellinus erectus* David et al., are reported as new to Spain. The presence on the islands of *Asterostroma gaillardii* Pat., a neglected taxon, is confirmed. The taxonomic position of *Cerocorticium canariensis* Manjón & Moreno is discussed and it is concluded that it should be included in *Phlebiella*. This decision implies the following nomenclatural proposals: *Phlebiella canariensis* (Manjón & Moreno) Tellería et al., *comb. nov.; Ph. albida* (Hauerslev) Tellería et al., *comb. nov.; Ph. boidinii* Tellería et al., *nom. & comb. nov.; Ph. bourdotii* (Boidin & Gilles) Tellería et al., *comb. nov.* and *Ph. pruina* (H. Bourdot & Galzin) Tellería et al., *comb. nov.*

Resumen

Sobre la base de datos propios y procedentes de la bibliografía, se presenta un catálogo de los Aphyllophorales resupinados no poroides (Corticiaceae *s.l.*) y Aphyllophorales poroides (Polyporaceae *s.l.)* de las Islas Baleares. Se concluye que las islas mejor estudiadas son las de Mallorca y Menorca, que suponen un 86,6 % del territorio balear; los escasos datos de Ibiza proceden de la bibliografía así como los de Cabrera y otros islotes; solo conocemos dos citas para Formentera. Se relacionan un total de 176 táxones, de los que 62 son nuevos para el archipiélago. Se citan por primera vez para España: *Fomitiporia erecta* (David et al.) Fiasson, *Parmas-*

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tomyces transmutans (Overh.) Ryvarden & Gilb., *Peniophora boidini* Reid y *Peniophora rufomarginata* (Pers.) Litsch. Se reivindica la presencia en las islas de *Asterostroma gaillardi* Pat., un taxon olvidado. Se discute la adscripción de *Cerocorticium canariensis* Manjón & Moreno y se concluye con su inclusión en *Phlebiella*. Esta decisión implica las siguientes propuestas nomenclaturales: *Phlebiella canariensis* (Manjón & Moreno) Tellería et al., *comb. nov.; Phlebiella albida* (Hauerslev) Tellería et al., *comb. nov.; Phlebiella boidinii* Tellería et al., *nom. & comb. nov.; Phlebiella bourdotii* (Boidin & Gilles) Tellería et al., *comb. nov.*, y *Phlebiella pruina* (H. Bourdot & Galzin) Tellería et al., *comb. nov.*

Introduction

The Balearic Islands form an archipelago in the Mediterranean sea, midway between Barcelona and Algeria. The islands are disposed from Southwest to Northeast: Menorca (Mn) in the Northeast, Formentera (Fo) in the South and Ibiza (Ib) in the West. There are three larger islands: Mallorca (Mll), Menorca (Mn) and Ibiza (Ib); two smaller ones: Formentera (Fo) and Cabrera (PM), and numerous islets on the periphery of the larger islands (fig.1).

This study was based on collections from Menorca, which with Mallorca cover about 86.6% of the territory (of the 5,014 km² of the archipelago, 3,640 correspond to Mallorca, i. e. about 72.6% of the total area, and 701 km² to Menorca, i.e. 14% of the total area). Records on Mallorca, Ibiza, Formentera and Cabrera and the little islets proceed from the literature.

The climate of the islands is Mediterranean, with cool wet winters and hot dry summers. The mean annual temperature is 17 ºC and the precipitation about 500 mm. The vegetation is affected by prolonged human activity. In a first approach, the vegetation of Mallorca and Menorca –known as the Gimnesias– can be distinguished from those of Ibiza and Formentera –known as the Pitiusas–, which is closer to that of

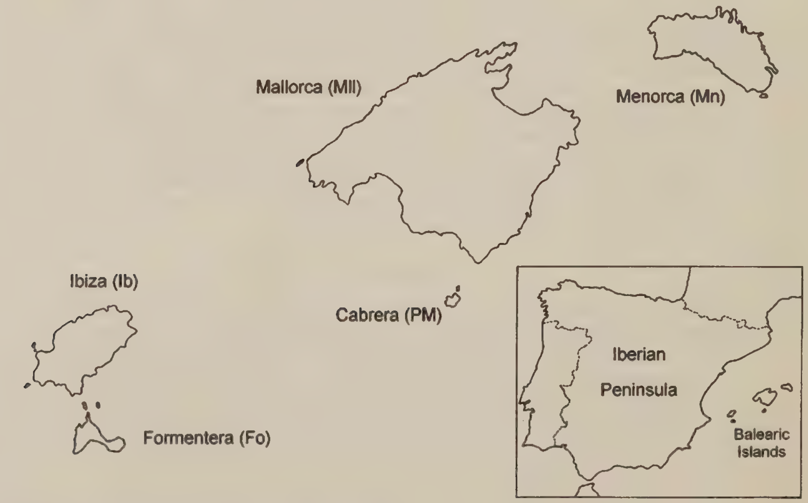

Fig. 1.–Geographical location of the Balearic Islands.

the east of the Iberian Peninsula. The dominant woodland is the Aleppo pine forest *(Pinus halepensis),* interspersed with umbrella pine *(Pinus pinea)* in Ibiza and Formentera, and with Phoenicean juniper *(Juniperus phoenicea).* Large stands of holm oak *(Quercus ilex)* are found in the vicinity of pine forests in the Gimnesias. The garrigue (evergreen shrubs), is dominated by narrow-leaved rock rose *(Cistus albidus),* lentisc *(Pistacia lentiscus),* heather *(Erica* sp.) and dwarf fan palm *(Chamaerops humilis).* Olive *(Olea europaea),* carob *(Ceratonia siliqua),* fig *(Ficus carica),* almond *(Amygdalus dulcis),* grape *(Vitis vinifera),* orange *(Citrus aurantium)* and lemon *(Citrus limon)* are extensively cultivated. It is worth remarking on the importance of some ornamental species as substrates for fungi, i.e. agave *(Agave americana),* date palm *(Phoenix dactylifera)* and prickly pear *(Opuntia vulgaris).*

Materials and Methods

This work is based on original data, proceeding from the study of specimens collected during the IV Fungus Foray of the Flora Mycologica Iberica Project, which took place in Menorca, and on previous bibliografic records (tab. 1).

As original data, we include location, date of collection, substrate and sample number; the initials M.D. are those of M. Dueñas, and Tell. stands for M.T. Tellería.

TABLE 1
REFERENCES ON PREVIOUS RECORDS

Authors	Mallorca (Mll)	Menorca (Mn)	Ibiza (Ib)	Formentera (Fo)	Cabrera (PM)
Aguasca et al. (1992)	♣				
Barceló i Combis (1881)	♣				
Boidin & Lanquetin (1987)		♣			
Bourdot & Galzin (1928)	♣				
Calonge et al. (1991)	♣				
Calonge et al. (1993)	♣				
Cambessèdes (1827)	♣				
Cardona (1986)		♣			
Colmeiro (1867a)	♣	♣			
Colmeiro (1867b)	♣	♣			
Colmeiro (1867c)	♣				
Colmeiro (1889)	♣				
Constantino & Siquier (1987)	♣				
Constantino & Siquier (1996)	♣	♣	♣		♣
Finschow (1978)			♣		
Finschow (1984)			♣		
Font Quer (1960)	♣				
Heim (1934)		♣			
Jahn (1971)	♣		♣		
Knoche (1921)	♣	♣			
Kotlaba (1975)			♣		
Llistosella & Aguasca (1990)		♣			
Malençon & Bertault (1972)	♣	♣			♣
Onsberg (1969)	♣				
Orell Casasnovas (1961)	♣				
Pérez de Gregorio (1995)	♣				

Table 1 (Continuation)

Authors	Mallorca (Mll)	Menorca (Mn)	Ibiza (Ib)	Formentera (Fo)	Cabrera (PM)
Pérez de Gregorio & Vidal (1994)	♣				
Reid (1975)		♣			
Rolland (1904)	♣				
Siquier (1994)				♣	
Siquier & Constantino (1982)	♣				
Siquier & Constantino (1995)			♣		
Siquier & Lillo (1994)					♣
Siquier et al. (1995)	♣				
Tellería (1980)	♣				
Tellería (1985)	♣				
Tellería (1990)	♣				
Tellería (1991a)	♣				♣
Tellería & Calonge (1977)					♣
Tellería & Navarro (1980)	♣				
Tellería et al. (1997)		♣			
Vidal et al. (1994)	♣				

List of species

The following list of species is based on original data; taxa new to the archipelago are marked with (*) and those to the Spain with (**). The complete catalogue based on original and bibliographic data is on table 2.

***Acanthophysium dextrinoideocerussatum** (Manjón et al.) Tellería

Material studied.–Menorca (Mn): Mercadal, Binifamis, 31SFE0128, 60 m.s.m., on *Arbutus unedo*, M. Dueñas, 15-XI-1990, 5672M.D.; ibidem, on *Pistacia lentiscus*, 15-XI-1990, 5670M.D.; ibidem, on unident. wood, J. Cardoso & I. Melo, 15-XI-1990, 5054I.Melo.

Fruiting on twigs of *Arbutus* and *Pistacia*, the Mediterranean distribution pattern of this species is further reinforced.

Malençon & Bertault (1972: 11) reported sterile material of *Aleurodiscus* sp. from Menorca (Mn). The strong dextrinoid character of the dendrophysis apices, the substrate on which it was found, *Pistacia lentiscus*, and other described characters, lead us to assign it to *A. dextrinoideocerussatum*.

Amphinema byssoides (Pers.: Fr.) J. Erikss.

Material studied.–Menorca (Mn): Mahón, S'Albufera, 31TFE0823, s. l., on *Rosmarinus officinalis*, J. Cardoso & I. Melo, 15-XI-1990, 5119I.Melo, LISU; idem, 5123I.Melo, LISU. Mercadal, Binifamis, 30TFE0128, 60m, on *Quercus ilex*, 15-XI-1990, 10673Tell., MA-Fungi; ibidem, on *Pinus halepensis*, 15-XI-1990, 10709Tell., MA-Fungi; idem, 10711Tell., MA-Fungi. Mercadal, Santa Eulalieta, 31SEE9725, 110m, on *Pinus halepensis*, 16-XI-1990, 10768Tell., MA-Fungi; idem, 10767Tell., MA-Fungi; idem, 10754Tell., MA-Fungi; idem, 5766MD., MA-Fungi; ibidem, on *Cistus* sp., 16-XI-1990, 10758Tell., MA-Fungi; ibidem, 10759Tell., MA-Fungi.

A great part of the Balearic material differs from typical *A. byssoides*. A specimen with a white basidiome, hyaline cystidia with slightly capitate apices, sometimes strongly encrusted (even the basidia), could be assigned to *A. tomentellum* (Bres.) M. P. Christ. In the absence of more detailed studies using other taxonomic evidence than morphological, we follow the criteria utilized in *Flora Mycologica Iberica* (cf. Tellería & Melo, 1995) and consider the above material as *A. byssoides* collections marked with a (#) under material studied.

***Antrodia albidoides** David & Dequatre

Material studied.–Menorca (Mn): Mercadal, Binifamis, 31SFE0128, 60 m.s.m., on *Phillyrea angustifolia*, J. Cardoso & I. Melo, 15-XI-1990, 5045I.Melo. Mercadal, Santa Eulalieta, 31SEE9725, 120 m.s.m., on *Quercus ilex*, J. Cardoso & I. Melo, 16-XI-1990, 5161I.Melo.

Growing on trees and shrubs of the Mediterranean evergreen forest; wood of *Phillyrea, Quercus, Viburnum, Arbutus*, etc., seem to be its favourite substrate. Reported from France (David & Dequatre, 1985: 359, 360), Italy (Bernicchia, 1990: 66), Portugal (David & Dequatre, 1985: 360; Melo, 1989a: 298; Niemelä & Pentilla, 1992: 63) and Cáceres in peninsular Spain (Manjón et al., 1990: 150).

***Antrodia ramentacea** (Berk. & A.Braun) Donk

Material studied.–Menorca (Mn): Mercadal, Santa Eulalieta, 31SEE9725, 120 m.s.m., on *Pinus halepensis*, J. Cardoso & I. Melo, 16-XI-1990, 5057I.Melo.

***Antrodia sinuosa** (Fr.) P. Karst.

Material studied.–Menorca (Mn): Mercadal, Santa Eulalieta, 31SEE9725, 120 m.s.m., on *Pinus halepensis*, J. Cardoso & I. Melo, 16-XI-1990, 5125I.Melo; idem, 5143I.Melo.

Asterostroma gaillardii Pat., J. Bot. (Morot) 8: 220. 1894

Typus.–In FH, Herb. Patouillard nº 3618. Bou Chebka, Tunisie, sur le bois dénudé du Pin d'Alep.

Material studied.–Menorca (Mn): Mahón, S'Albufera, 31SFE0823, s. l., on *Pinus halepensis*, J. Cardoso & I. Melo, 16-XI-1990, 5110I.Melo.

We confirm the presence of this long forgotten taxon and which Bourdot & Galzin (1928: 400) briefly reported from Mallorca: "frag. ex herb. Pat., Majorque: R. Maire, Mycoth. boreali-afric., n. 264".

We have not had the opportunity to study the nomenclatural type (FH) but we have studied the exsiccatum of Maire "Mycoth. boreali-afric, n. 264", from Algeria: Oued-Djer" (fig. 3), also on *Pinus halepensis.*

Our specimen (fig. 2) perfectly fits the material of Maire (fig. 3), deposited in MA(MA-funhis 08620). Figs. 2 and 3 show microscopic characters of material from Menorca and Algeria respectively. Bourdot & Galzin (1928: 400) compare this species with *A. cervicolor*. The differences between both taxa are evident especially in spore shape: subglobose, tuberculate (tubercles up to 1.5 µm long) in *A. gaillardii* (figs. 2, 3) and broadly ellipsoid, up to 0.5 µm long tubercles in *A. cervicolor* (fig. 4).

***Athelia decipiens** (Höhn. & Litsch.) J. Erikss.

Material studied.–Menorca (Mn): Mercadal, Santa Eulalieta, 31SEE9725, 120 m.s.m., on *Asphodelus* sp., M.T. Tellería, 16-XI-1990, 10791Tell.

***Botryobasidium botryosum** (Bres.) J. Erikss.

Material studied.–Menorca (Mn): Ciutadella, La Vall, 31TEE8033, 20 m.s.m., on *Scirpus* sp., M.T. Tellería, 17-XI-1990, 10859Tell.

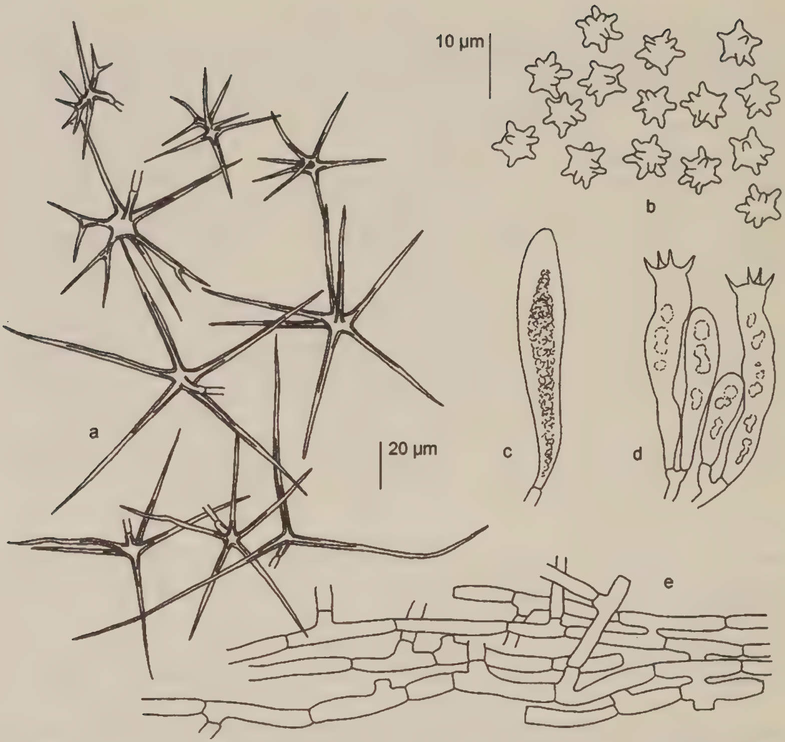

Fig. 2.–*Asterostroma gaillardii* [I. Melo & J. Cardoso 5110]: a, asterosetae; b, spores; c, cystidia; d, basidia; e, basal hyphae.

***Botryohypochnus isabellinus** (Fr.) J. Erikss.

Material studied.–Menorca (Mn): Ciutadella, La Vall, 31TEE8033, 20 m.s.m., on *Pinus halepensis*, M.T. Tellería, 17-XI-1990, 10818Tell.; idem, 5800M.D.; ibidem, on *Quercus ilex*, 17-XI-1990, 10844Tell.; idem, 10845Tell.; idem, 10846Tell.; idem, 5243I.Melo. Mahón, S'Albufera, 31TFE0823, s. l., on *Pinus pinaster*, J. Cardoso & I. Melo, 17-XI-1990, 5111I.Melo; ibidem, on *Rosmarinus officinalis*, 17-XI-1990, 5121I.Melo. Mercadal, sand dunes of Son Saura, 31TEE9932, s. l., on *Arbutus unedo*, M.T. Tellería, 15-XI-1990, 10729Tell. Mercadal, Binifamis, 31SFE0128, 60 m.s.m., on *Pinus halepensis*, M.T. Tellería, 15-XI-1990, 10713Tell.; ibidem, on *Quercus ilex*, J. Cardoso & I. Melo, 15-XI-1990, 5077I.Melo. Mercadal, Santa Eulalieta, 31SEE9725, 120 m.s.m., on *Pinus halepensis*, J. Cardoso & I. Melo, 16-XI-1990, 5115I.Melo.

***Brevicellicium olivascens** (Bres.) Larsson & Hjortstam

Material studied.–Menorca (Mn): Mahón, Alayor, Son Bou, 31SEE9117, s. l., on *Myoporum acuminatum*, J. Cardoso & I. Melo, 16-XI-1990, 5194I.Melo.

***Ceriporia viridans** (Berk. & A. Braun) Donk

Material studied.–Menorca (Mn): Mercadal, Binifamis, 31SFE0128, 60 m.s.m., on *Pinus halepensis*, M. Dueñas, 15-XI-1990, 5690M.D.

Coniophora arida (Fr.) P. Karst. var. **arida**

Material studied.–Menorca (Mn): Mercadal, Santa Eulalieta, 31SEE9725, 120 m.s.m., on *Pinus halepensis*, M.T. Tellería, 16-XI-1990, 10737Tell.

Crustoderma dryinum (Berk. & M.A. Curtis) Parmasto

Material studied.–Menorca (Mn): Ciutadella, La Vall, 31TEE8033, 20 m.s.m., on *Pinus halepensis*, M.T. Tellería, 17-XI-1990, 10891Tell.; idem, 5232I.Melo. Mercadal, Santa Eulalieta, 31SEE9725, 120 m.s.m., on *Pinus halepensis*, M.T. Tellería, 16-XI-1990, 10766Tell.; idem, 10745Tell.; idem, 5137I.Melo; idem, 5145I.Melo.

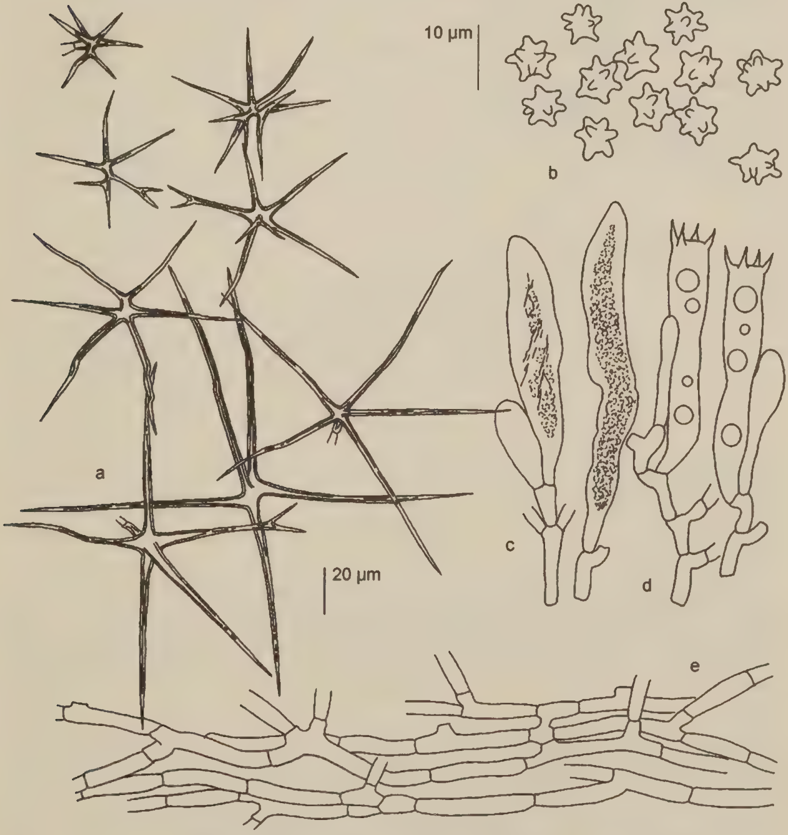

Fig. 3.–*Asterostroma gaillardii* [MA-funhist 08620]: a, asterosetae; b, spores; c, cystidia; d, basidia; e, basal hyphae.

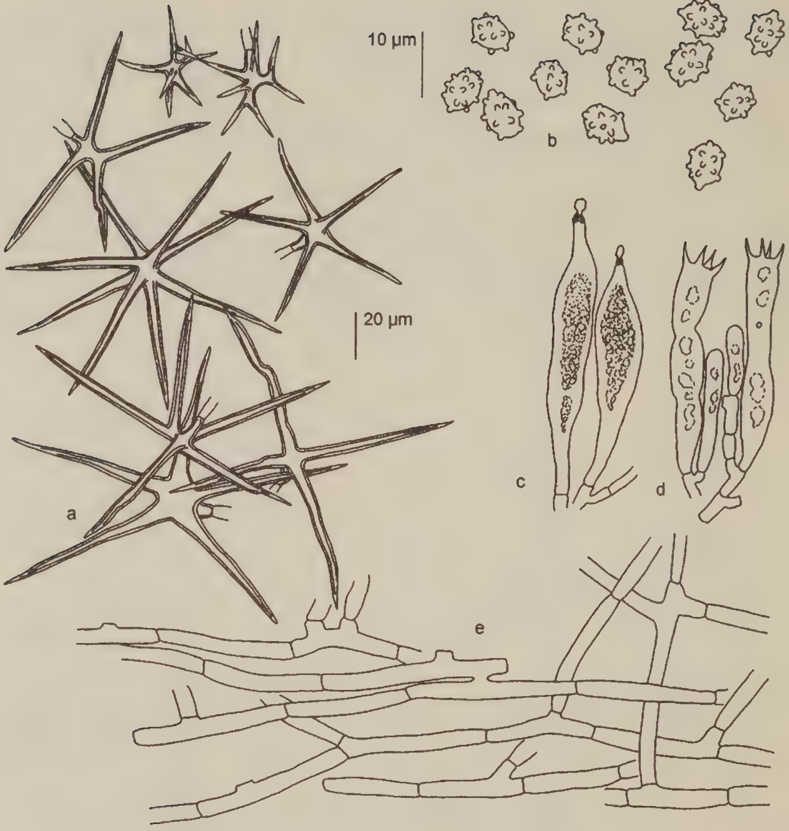

Fig. 4.–*Asterostroma cervicolor* [K, Herb. Berk. n.° 4026]: a, asterosetae; b, spores; c, cystidia; d, basidia; e, basal hyphae.

***Dendrocorticium polygonioides** (P. Karst.) M.J. Larsen & Gilb.

Material studied.–Menorca (Mn): Mercadal, Binifamis, 31SFE0128, 60 m.s.m., on *Ficus carica*, M.T. Tellería, 15-XI-1990, 10686Tell.; ibidem, on *Pinus halepensis*, M. Dueñas, 15-XI-1990, 5676M.D.; ibidem, on *Pistacia lentiscus*, 15-XI-1990, 5671M.D.

Dichomitus campestris (Quél.) Domanski & Orlós

Material studied.–Menorca (Mn): Mercadal, Santa Eulalieta, 31SEE9725, 120 m.s.m., on *Arbutus unedo*, M. Dueñas, 16-XI-1990, 5730M.D.; ibidem, on *Quercus ilex*, J. Cardoso & I. Melo, 16-XI-1990, 5167I.Melo; idem, 5038I.Melo.; ibidem, on indect. wood, M. Dueñas, 16-XI-1990, 5728M.D. Mercadal, Binifamis, 31SFE0128, 60 m.s.m., on *Olea europaea*, M. Dueñas, 15-XI-1990, 5697M.D.

Dichomitus squalens (P. Karst.) Reid

Material studied.–Menorca (Mn): Mercadal, Santa Eulalieta, 31SEE9725, 120 m.s.m., on *Pinus halepensis*, M. Dueñas, 16-XI-1990, 5769M.D. Mercadal, Binifamis, 31SFE0128, 60 m.s.m., on *Pinus halepensis*, M. Dueñas, 15-XI-1990, 5674M.D.

***Gloeocystidiellum olivaceo-album** (H. Bourdot & Galzin) Tellería

Material studied.–Menorca (Mn): Ciutadella, La Vall, 31TEE8033, 20 m.s.m., on *Pinus halepensis*, J. Cardoso & I. Melo, 15-XI-1990, 5211I.Melo; ibidem, on *Quercus ilex*, 15-XI-1990, 5202I.Melo. Mercadal, Santa Eulalieta, 31SEE9725, 120 m.s.m., on *Pinus halepensis*, M.T. Tellería, 16-XI-1990, 10765Tell.; idem, 10793Tell. Mercadal, Binifamis, 31SFE0128, 60 m.s.m., on *Pinus halepensis*, J. Cardoso & I. Melo, 15-XI-1990, 5050I.Melo. Mercadal, Santa Eulalieta, 31SEE9725, 120 m.s.m., on *Pinus halepensis*, J. Cardoso & I. Melo, 16-XI-1990, 5132I.Melo.

Gloeophyllum abietinum (Bull.: Fr.) P. Karst.

Material studied.–Menorca (Mn): Mercadal, Santa Eulalieta, 31SEE9725, 120 m.s.m., on *Pinus halepensis*, J. Cardoso & I. Melo, 16-XI-1990, 5146I.Melo; idem, 5158I.Melo.

Hymenochaete cinnamomea (Pers.) Bres.

Material studied.–Menorca (Mn): Ciutadella, La Vall, 31TEE8033, 20 m.s.m., on *Cistus* sp., M. Dueñas, 17-XI-1990, 5823M.D.; ibidem, on *Erica* sp., J. Cardoso & I. Melo, 17-XI-1990, 5245I.Melo. Mercadal, Binifamis, 31SFE0128, 60 m.s.m., on *Quercus ilex*, M.T. Tellería, 15-XI-1990, 10659Tell.

***Hyphoderma medioburiense** (Burt) Donk

Material studied.–Menorca (Mn): Ciutadella, La Vall, 31TEE8033, 20 m.s.m., on *Quercus ilex*, M.T. Tellería, 17-XI-1990, 10856Tell.; idem, 10853Tell.; idem, 10847Tell.; idem, 5209I.Melo; idem, 5218I.Melo; idem, 5237I.Melo; idem, 10826Tell. Mahón, Alayor, Son Bou, 31SEE9117, s. l., on *Phoenix canariensis*, J. Cardoso & I. Melo, 16-XI-1990, 5189I.Melo; idem, 5789M.D.; idem, 5149I.Melo; idem, 5151I.Melo. Mahón, S'Albufera, 31SFE0823, s. l., on *Pistacia lentiscus*, M. Dueñas, 15-XI-1990, 5724M.D.

Hyphoderma praetermissum (P. Karst.) J. Erikss. & Strid

Material studied.–Menorca (Mn): Ciutadella, La Vall, 31TEE8033, 20m, on *Olea europaea*, M. Dueñas, 17-XI-1990, 5809M.D.; ibidem, on *Quercus ilex*, M.T. Tellería, 17-XI-1990, 10856Tell.; idem, 5817M.D.; idem, 5793M.D. Mercadal, Binifamis, 31SFE0128, 60m, on *Arbustus unedo*, M.T. Tellería, 15-XI-1990, 10670Tell.; ibidem, on *Pinus halepensis*, 15-XI-1990, 10644Tell.; idem, 10714Tell.; ibidem, on *Pistacia lentiscus*, M. Dueñas, 15-XI-1990, 5657M.D.; idem, 5659M.D.; ibidem, on *Quercus ilex*, 15-XI-1990, 5677M.D. Mercadal, Santa Eulalieta, 31SEE9725, 110 m.s.m., on *Pinus halepensis*, M.T. Tellería, 16-XI-1990, 10769Tell.; idem, 10775Tell.; idem, 10770Tell.; idem, 5746M.D.; ibidem, on *Quercus ilex*, M.T. Tellería, 16-XI-1990, 10736Tell.; idem, 10779Tell.; idem, 5762M.D.

***Hyphoderma puberum** (Fr.) Wallr.

Material studied.–Menorca (Mn): Mercadal, Binifamis, 31SFE0128, 60 m.s.m., on *Pinus halepensis*, M.T. Tellería, 15-XI-1990, 10719Tell.

***Hyphodermella corrugata** (Fr.) J. Erikss. & Ryvarden

Material studied.–Menorca (Mn): Mercadal, sand dunes of Son Saura, 31TEE9932, on *Cupressus* sp., J. Cardoso & I. Melo, 15-XI-1990, 5096I.Melo. Mercadal, Binifamis, 31SFE0128, 60 m.s.m., on *Ficus carica*, M.T. Tellería, 15-XI-1990, 10690Tell.; ibidem, on *Quercus ilex*, J. Cardoso & I. Melo, 15-XI-1990, 5067I.Melo.

***Hyphodontia aspera** (Fr.) J. Erikss.

Material studied.–Menorca (Mn): Mercadal, Santa Eulalieta, 31SEE9725, 110 m.s.m., on *Pinus halepensis*, M.T. Tellería, 16-XI-1990, 10750Tell.; ibidem, on unident. wood, 16-XI-1990, 10792Tell.

Hyphodontia crustosa (Pers.: Fr.) J. Erikss.

Material studied.–Menorca (Mn): Mercadal, sand dunes of Son Saura, 31TEE9932, s. l., on *Arbutus unedo*, M.T. Tellería, 15-XI-1990, 10726Tell.; ibidem, on *Pinus halepensis*, J. Cardoso & I. Melo, 15-XI-1990, 5098I.Melo; idem, 10722Tell.; idem, 5712M.D. Mercadal, Santa Eulalieta, 31SEE9725, 110 m.s.m., on *Rosmarinus officinalis*, M. Dueñas, 15-XI-1990, 5712M.D.

***Hyphodontia juniperi** (H. Bourdot & Galzin) J. Erikss.

Material studied.–Menorca (Mn): Mercadal, Binifamis, 31SFE0128, 60 m.s.m., on *Pinus halepensis*, M.T. Tellería, 15-XI-1990, 10702Tell.

Hyphodontia sambuci (Pers.) J. Erikss.

Material studied.–Menorca (Mn): Ciutadella, La Vall, 31TEE8033, 20 m.s.m., on *Ficus carica*, M.T. Tellería, 17-XI-1990, 10894Tell. Mahón, Alayor, Son Bou, 31SEE9117, s. l., on *Phoenix canariensis*, M.T. Tellería, 16-XI-1990, 10813Tell.; idem, 5190I.Melo; idem, 5195I.Melo; ibidem, on *Pinus halepensis*, I. Melo, 16-XI-1990, 5199I.Melo; idem, 10810Tell.; ibidem, on *Scirpus* sp., M.T. Tellería, 16-XI-1990, 10807Tell.; ibidem, on unident. wood, 16-XI-1990, 10809Tell. Mahón, S'Albufera, 31SFE0823, s. l., on *Asteraceae*, M. Dueñas, 15-XI-1990, 5719M.D.; ibidem, on *Rosmarinus officinalis*, J. Cardoso & I. Melo, 15-XI-1990, 5113I.Melo. Mercadal, sand dunes of Son Saura, 31TEE9932, s. l., on *Cupressus* sp., J. Cardoso & I. Melo, 15-XI-1990, 5097I.Melo. Mercadal, Binifamis, 31SFE1028, 60 m.s.m., on *Ficus carica*, J. Cardoso & I. Melo, 15-XI-1990, 5178I.Melo; idem, 5179I.Melo; idem, 10689Tell.; ibidem, on burnt wood, M. Dueñas, 15-XI-1990, 5664M.D. Mercadal, Cala Tirant, 31TEE9333, s. l., on *Tamarix* sp., M.T. Tellería, 16-XI-1990, 10800Tell.; idem, 5178I.Melo; idem, 5188I.Melo.

***Hyphodontia subalutacea** (P. Karst.) J. Erikss. var. **subalutacea**

Material studied.–Menorca (Mn): Ciutadella, La Vall, 31TEE8033, 20 m.s.m., on *Pinus halepensis*, J. Cardoso & I. Melo, 17-XI-1990, 5220I.Melo. Mercadal, Binifamis, 31SFE0128, 60 m.s.m., on *Pinus halepensis*, M.T. Tellería, 15-XI-1990, 10703Tell.; idem, 10707Tell.; idem, 5057I.Melo.

***Hyphodontia subalutacea** var. **floccosa** (H. Bourdot & Galzin) Tellería & Melo

Material studied.–Menorca (Mn): Mercadal, Binifamis, 31SFE0128, 60 m.s.m., on *Pinus halepensis*, J. Cardoso & I. Melo, 15-XI-1990, 5051I. Melo.

***Hypochnicium sphaerosporum** (Höhn. & Litsch.) J. Erikss.

Material studied.–Menorca (Mn): Mercadal, Binifamis, 31SFE0128, 60 m.s.m., on grass, M. Dueñas, 15-XI-1990, 5660M.D.

***Inonotus cuticularis** (Bull.: Fr.) P. Karst.

Material studied.–Menorca (Mn): Mercadal, Binifamis, 31SFE0128, 60 m.s.m., on *Quercus ilex*, J. Cardoso & I. Melo, 15-XI-1990, 5072I.Melo.

Inonotus tamaricis (Pat.) Maire

Material studied.–Menorca (Mn): Mercadal, Cala Tirant, 31TEE9333, s. l., on *Tamarix* sp., J. Cardoso & I. Melo, 16-XI-1990, 5174I.Melo. Mercadal, Cala Tirant, 31TEE9333, s. l., on *Tamarix* sp., M. Dueñas, 16-XI-1990, 5778M.D.

***Lagarobasidium detriticum** (H. Bourdot & Galzin) Jülich

Material studied.–Menorca (Mn): Mercadal, Binifamis, 31SFE0128, 60 m.s.m., on grass, M. Dueñas, 15-XI-1990, 5701M.D.; idem, 5703M.D.

***Laxitextum bicolor** (Pers.: Fr.) Parmasto

Material studied.–Menorca (Mn): Ciutadella, La Vall, 31TEE8033, 20 m.s.m., on *Pinus halepensis*, M. Dueñas, 17-XI-1990, 5807M.D.

***Litschauerella clematitis** (H. Bourdot & Galzin) J. Erikss. & Ryvarden

Material studied.–Menorca (Mn): Mercadal, Binifamis, 31SFE0128, 60 m.s.m., on *Arbutus unedo*, M.T. Tellería, 15-XI-1990, 10687Tell. Mercadal, Santa Eulalieta, 31SEE9725, 120 m.s.m., on *Pinus halepensis*, J. Cardoso & I. Melo, 16-XI-1990, 5156I.Melo.

Meruliopsis corium (Pers.: Fr.) Ginns

Material studied.–Menorca (Mn): Ciutadella, La Vall, 31TEE8033, 20 m.s.m., on *Quercus ilex*, J. Cardoso & I. Melo, 17-XI-1990, 5223I.Melo. Mercadal, Binifamis, 31SFE0128, 60 m.s.m., on *Ficus carica*, M.T. Tellería, 15-XI-1990, 10683Tell. Mercadal, Santa Eulalieta, 31SEE9725, 120 m.s.m., on *Quercus ilex*, M.T. Tellería, 16-XI-1990, 10771Tell.

***Meruliopsis hirtellus** (Burt) Ginns

Material studied.–Menorca (Mn): Ciutadella, La Vall, 31TEE8033, 20 m.s.m., on *Pinus halepensis*, J. Cardoso & I. Melo, 17-XI-1990, 5221I.Melo; idem, 5225I.Melo; idem, 5253I.Melo. Mercadal, Santa Eulalieta, 31SEE9725, 120 m.s.m., on *Pinus halepensis*, J. Cardoso & I. Melo, 16-XI-1990, 5234I.Melo; idem, 5236I.Melo. Mercadal, Binifamis, 31SFE0128, 60 m.s.m., on *Pinus halepensis*, J. Cardoso & I. Melo, 15-XI-1990, 5039I.Melo; idem, 5093I.Melo; idem, 5095I.Melo.

***Mycoacia aurea** (Fr.) J. Erikss. & Ryvarden

Material studied.–Menorca (Mn): Mercadal, Binifamis, 31SFE0128, 60 m.s.m., on *Pistacia lentiscus*, M. Dueñas, 15-XI-1990, 5807M.D.; ibidem, on *Quercus ilex*, J. Cardoso & I. Melo, 15-XI-1990, 5090I.Melo.

***Mycoacia fuscoatra** (Fr.: Fr.) Donk

Material studied.–Menorca (Mn): Ciutadella, La Vall, 31TEE8033, 20 m.s.m., on *Pinus halepensis*, J. Cardoso & I. Melo, 17-XI-1990, 5221I.Melo; idem, 5224I.Melo; idem, 5229I.Melo. Mercadal, Santa Eulalieta, 31SEE9725, 120 m.s.m., on *Pinus halepensis*, J. Cardoso & I. Melo, 16-XI-1990, 5238I.Melo; idem, 5252I.Melo; idem, 5254I.Melo. Mercadal, Binifamis, 31SFE0128, 60 m.s.m., on *Pinus halepensis*, J. Cardoso & I. Melo, 15-XI-1990, 5044I.Melo; idem, 5046I.Melo; idem, 5092I.Melo.

***Oligoporus inocybe** (David & Malençon) Gilb. & Ryvarden

Material studied.–Menorca (Mn): Ciutadella, Son Morell, 31TEE7331, 20 m.s.m., on timber, J. Cardoso & I. Melo, 17-XI-1990, 5256I.Melo. Mercadal, Binifamis, 31SFE0128, 60 m.s.m., on *Pinus halepensis*, J. Cardoso & I. Melo, 15-XI-1990, 5094I.Melo; idem, 5683M.D.; idem, 5688M.D.

These records support the known distribution of this species (cf. RYVARDEN & GILBERTSON, 1994: 415-416) which so far was exclusively the center and western Mediterranean countries: Portugal, peninsular Spain, France and Italy.

Oligoporus leucomallellus (Murrill) Gilb. & Ryvarden

Material studied.–Menorca (Mn): Mercadal, Santa Eulalieta, 31SEE9725, 120 m.s.m., on *Pinus halepensis*, J. Cardoso & I. Melo, 16-XI-1990, 5126I.Melo. Mercadal, Binifamis, 31SFE0128, 60 m.s.m., on *Pinus halepensis*, J. Cardoso & I. Melo, 15-XI-1990, 5048I.Melo.

****Parmastomyces transmutans** (Overh.) Ryvarden & Gilb.

Material studied.–Menorca (Mn): Mercadal, Santa Eulalieta, 31SEE9725, 120 m.s.m., on *Pinus halepensis*, J. Cardoso & I. Melo, 16-XI-1990, 5153I.Melo.

This record support the distribution of this species in the western Mediterranean, where it is known from France and Portugal (cf. RYVARDEN & GILBERTSON, 1994: 450). The strong dextrinoid character of the spore wall differentiates this species from *Oligoporus fragilis* (Pat.) Fiasson & Niemelä, morphologically very similar.

****Peniophora boidinii** Reid

Material studied.–Menorca (Mn): Mercadal, Santa Eulalieta, 31SEE9725, 120 m.s.m., on *Arbutus unedo*, J. Cardoso & I. Melo, 16-XI-1990, 5169I.Melo; idem, 5738I.Melo; idem, 5741I.Melo; idem, 5743I.Melo; idem, 5753I.Melo; idem, 5734I.Melo; ibidem, on *Erica arborea*, M. Dueñas, 16-XI-1990, 5772M.D. Mercadal, Binifamis, 31SFE0128, 60 m.s.m., on *Arbutus unedo*, M.T. Tellería, 15-XI-1990, 10682Tell.; ibidem, on *Erica arborea*, M. Dueñas, 15-XI-1990, 5686M.D.; ibidem, on *Olea europaea*, 15-XI-1990, 5695M.D.; idem, 5696M.D.; ibidem, on *Phillyrea* sp., M.T. Tellería, 15-XI-1990, 10657Tell.; ibidem, on *Pistacia lentiscus*, J. Cardoso & I. Melo, 15-XI-1990, 5035I.Melo; idem, 5043I.Melo; idem, 10674Tell.; idem, 5704M.D.; ibidem, on *Quercus ilex*, 15-XI-1990, 5086I.Melo; idem, 5663M.D.; ibidem, on unident. wood, M. Dueñas, 15-XI-1990, 5702M.D.

Reported from France, Portugal and Morocco, it has now been found in the Balearic Islands, being common in Menorca on the usual substrates (cf. BOIDIN, 1994: 326); it is not yet known from peninsular Spain. Very close to *P. versicolor* Boidin from which it can be distinguished by the smaller spore size, 5.6-8.7 × 2.5-3.7 µm.

Peniophora lycii (Pers.) Höhnel & Litsch.

Material studied.–Menorca (Mn): Ciutadella, Son Morell, 31TEE7331, 20 m.s.m., on *Prunus dulcis*, J. Cardoso & I. Melo, 17-XI-1990, 5255I.Melo; idem, 10895Tell. Ciutadella, La Vall, 31TEE8833, 20 m.s.m., on *Quercus ilex*, J. Cardoso & I. Melo, 17-XI-1990, 5219I.Melo; idem, 5227I.Melo; ibidem, on unidentif. wood, M.T. Tellería, 17-XI-1990, 10830Tell. Mahón, Alayor, Son Bou, 31SEE9117, s. l., on *Inula conyza*, J. Cardoso & I. Melo, 16-XI-1990, 5196I.Melo; ibidem, on *Phoenix canariensis*, 16-XI-1990, 5198I.Melo; ibidem, on *Scirpus* sp., M.T. Tellería, 16-XI-1990, 10808Tell.; ibidem, on unident. wood, 16-XI-1990, 10814Tell. Mahón, S'Albufera, 31SFE0823, s. l., on *Phillyrea* sp., M.T. Tellería, 15-XI-1990, 10736Tell.; ibidem, on *Pistacia lentiscus*, M. Dueñas, 15-XI-1990, 5721M.D.; idem, 5723M.D. Mercadal, Santa Eulalieta, 31SEE9725, 110 m.s.m., on *Phillyrea* sp., M. Dueñas, 16-XI-1990, 5732M.D.; ibidem, on *Pinus halepensis*, M.T. Tellería, 16-XI-1990, 10764Tell.; ibidem, on *Quercus ilex*, 16-XI-1990, 10773Tell.

Peniophora meridionalis Boidin

Material studied.–Menorca (Mn): Ciutadella, La Vall, 31TEE8033, 20 m.s.m., on *Erica* sp., J. Cardoso & I. Melo, 17-XI-1990, 5246I.Melo; ibidem, on *Quercus ilex*, 17-XI-1990, 5234I.Melo; idem, 10832Tell.; idem, 10834Tell.; idem, 10843Tell. Mahón, Alayor, Son Bou, 31SEE9117, s. l., on *Pinus halepensis*, J. Cardoso & I. Melo, 16-XI-1990, 5200I.Melo. Mercadal, Santa Eulalieta, 31SEE9725, 120 m.s.m., on *Arbutus unedo*, M. Dueñas, 16-XI-1990, 5741M.D.; ibidem, on *Pinus halepensis*, 16-XI-1990, 5770M.D.; ibidem, on *Quercus ilex*, J. Cardoso & I. Melo, 16-XI-1990, 5159I.Melo; idem, 10773Tell.; idem, 10772Tell.; idem, 5760M.D. Mercadal, Binifamis, 31SFE0128, 60 m.s.m., on *Quercus ilex*, J. Cardoso & I. Melo, 15-XI-1990, 5042I.Melo.

Peniophora quercina (Pers.: Fr.) Cooke

Material studied.–Menorca (Mn): Ciutadella, La Vall, 31TEE8033, 20 m.s.m., on *Erica* sp., J. Cardoso & I. Melo, 17-XI-1990, 5234I.Melo. Mercadal, Santa Eulalieta, 31SEE9725, 120 m.s.m., on *Quercus ilex*, M. Dueñas, 16-XI-1990, 5759M.D.

****Peniophora rufomarginata** (Pers.) Litsch.

Material studied.–Menorca (Mn): Ciutadella, La Vall, 31TEE8033, 20 m.s.m., on *Quercus ilex*, J. Cardoso & I. Melo, 17-XI-1990, 5207I.Melo. Mercadal, Binifamis, 31SFE0128, 60 m.s.m., on *Quercus ilex*, J. Cardoso & I. Melo, 17-XI-1990, 5085I.Melo; idem, 5061I.Melo.

A species first considered exclusive of *Tilia* wood (ERIKSSON et al., 1978: 979), seems to have, at least in South Europe, a wide range of substrates and is found frequently on *Quercus* and other hosts (MELO, 1989b: 288, 292; BOIDIN, 1994: 330). Known to the Iberian mycoflora from Portugal [Melo in TELLERIA (ed.), 1992: 143-144] and now from the Balearic Islands. Certainly its distribution in the Iberian Peninsula is wider, but it has possibly been confused with *P. quercina.*

***Peniophora tamaricicola** Boidin & Malençon

Material studied.–Menorca (Mn): Mercadal, Cala Tirant, 31TEE9333, s. l., on *Tamarix* sp., M.T. Tellería, 16-XI-1990, 10797Tell.; idem, 10798Tell.; idem, 10802Tell.; idem, 10804Tell.; idem, 5173I.Melo; idem, 5177I.Melo; idem, 5180I.Melo; idem, 5182I.Melo; idem, 5184I.Melo; idem, 5775M.D.; idem, 5779M.D.

Peniophora versicolor (Bres.) Sacc. & Sydow

Material studied.–Menorca (Mn): Ciutadella, La Vall, 31TEE8033, 20 m.s.m., on *Quercus ilex*, J. Cardoso & I. Melo, 17-XI-1990, 5226I.Melo. Mahón, S'Albufera, 31SFE0823, s. l., on *Rosmarinus officinalis*, J. Cardoso & I. Melo, 15-XI-1990, 5116I.Melo. Mercadal, Binifamis, 31SFE0128, 60 m.s.m., on *Pinus halepensis*, M. Dueñas, 16-XI-1990, 5675M.D. Mercadal, Santa Eulalieta, 31SEE9725, 120 m.s.m., on *Quercus ilex*, M.T. Tellería, 16-XI-1990, 10787Tell.

Perenniporia ochroleuca (Berk.) Ryvarden

Material studied.–Menorca (Mn): Ciutadella, La Vall., 31TEE8033, 20 m.s.m., on unident. wood, J. Cardoso & I. Melo, 17-XI-1990, 5251I.Melo.

***Perenniporia rosmarini** David & Malençon

Material studied.–Menorca (Mn): Mahón, S'Albufera, 31SFE0823, s. l., on *Rosmarinus officinalis*, J. Cardoso & I. Melo, 15-XI-1990, 5120I.Melo.

***Phanerochaete deflectens** (P. Karst.) Hjortstam

Material studied.–Menorca (Mn): Mercadal, Binifamis, 31TFE0128, 60 m.s.m., on *Quercus ilex*, M.T. Tellería, 15-XI-1990, 10658Tell.; ibidem, on *Ficus carica*, M.T. Tellería, 15-XI-1990, 10692Tell.

Phanerochaete martelliana (Bres.) J. Erikss. & Ryvarden

Material studied.–Menorca (Mn): Mercadal, Cala Tirant, 31TEE9333, s. l., on *Tamarix sp.,* M.T.Tellería, 10799Tell.

***Phanerochaete sanguinea** (Fr.) Pouzar

Material studied.–Menorca (Mn): Mercadal, Binifamis, 31TFE0128, 60 m.s.m., on *Arbutus unedo*, M. Dueñas, 15-XI-1990, 5693M.D.; ibidem, on unident. wood, J. Cardoso & I. Melo, 15-XI-1990, 5071I.Melo.

***Phanerochaete sordida** (P. Karst.) J. Erikss. & Ryvarden

Material studied.–Menorca (Mn): Ciutadella, La Vall, 31TEE8033, 20 m.s.m., on *Quercus ilex*, M.T. Tellería, 17-XI-1990, 10854Tell. Mercadal, Santa Eulalieta, 31SEE9725, 120 m.s.m., on *Quercus ilex*, M.T. Tellería, 16-XI-1990, 10785Tell.; idem, 10786Tell. Mercadal, Binifamis, 31SFE0128, 60 m.s.m., on *Quercus ilex*, M. Dueñas, 15-XI-1990, 5669M.D.

****Phanerochaete xerophila** Burdsall

Material studied.–Menorca (Mn): Ciutadella, Son Morell, 31TEE7331, 20 m., on *Opuntia vulgaris,* J. Cardoso & I. Melo, 17-XI-1990, 5257I.Melo.

A rare species, described by BURDSALL (1985: 141) on fallen branches of desert shrubs and cacti in the United States, it was recently reported from Portugal (MELO, 1994: 103). Very close to *Ph. tuberculata* (P. Karst.) Parm., it differs by its pale yellowish basidiome with a farinaceous white margin, absence of cords in the subiculum, narrow basal hyphae and slightly longer spores.

****Phellinus erectus** David et al.

Material studied.–Menorca (Mn): Mercadal, sand dunes of Son Saura, 31TEE9932, s. l., on *Erica multiflora*, J. Cardoso & I. Melo, 15-XI-1990, 5107I.Melo; ibidem, on *Pinus halepensis* ?, 15-XI-1990, 5104I.Melo.

Species with a clearly Mediterranean distribution: it is known from France, Italy, former Yugoslavia and Portugal and is now reported from the Balearic Islands where its distribution is almost certainly larger.

***Phellinus ferreus** (Pers.) Bourdot & Galzin

Material studied.–Menorca (Mn): Mercadal, Santa Eulalieta, 31SEE9725, 120 m.s.m., on *Pinus halepensis*, J. Cardoso & I. Melo, 16-XI-1990, 5144I.Melo.

***Phellinus ferruginosus** (Schrad.: Fr.) Pat.

Material studied.–Menorca (Mn): Mercadal, Santa Eulalieta, 31SEE9725, 120 m.s.m., on *Pinus halepensis*, J. Cardoso & I. Melo, 16-XI-1990, 5129I.Melo; idem, 5140I.Melo; idem, 5142I.Melo. Mercadal, sand dunes of Son Saura, 31TEE9932, s. l., on *Pinus halepensis*, J. Cardoso & I. Melo, 15-XI-1990, 5101I.Melo; idem, 5102I.Melo; idem, 5103I.Melo; idem, 5105I.Melo.

Phellinus punctatus (P. Karst.) Pilát

Material studied.–Menorca (Mn): Ciutadella, La Vall, 31TEE8033, 20 m.s.m., on *Genista* sp., J. Cardoso & I. Melo, 17-XI-1990, 5239I.Melo. Mahón, S'Albufera, 31SFE0823, s. l., on *Rosmarinus officinalis*, J. Cardoso & I. Melo, 15-XI-1990, 5114I.Melo.

Phellinus robustus (P. Karst.) H. Bourdot & Galzin

Material studied.–Menorca (Mn): Ciutadella, La Vall, 31TEE8033, 20 m.s.m., on *Quercus ilex*, M. Dueñas, 17-XI-1990, 5822M.D.

***Phlebia livida** (Pers.: Fr.) Bres.

Material studied.–Menorca (Mn): Mercadal, sand dunes of Son Saura, 31TEE9932, 60 m.s.m., on *Pinus halepensis*, J. Cardoso & I. Melo, 15-XI-1990, 5100I.Melo.

***Phlebia subochracea** (Bres.) J. Erikss. & Ryvarden

Material studied.–Menorca (Mn): Mercadal, cala Tirant, 31TEE9333, s. l., on *Tamarix* sp., M. Dueñas, 16-XI-1990, 5784M.D.

***Phlebia subserialis** (H. Bourdot & Galzin) Donk

Material studied.–Menorca (Mn): Mercadal, Santa Eulalieta, 31SEE9725, 120 m.s.m., on *Pinus halepensis*, M.T. Tellería, 16-XI-1990, 10746Tell.

***Phlebiella canariensis** (Manjón & Moreno) Tellería, Melo & Dueñas, **comb. nov**.

≡*Cerocorticium canariensis* Manjón & Moreno, Bot. Macaronésica 10: 29. 1982 [1984] ≡*Epithele canariensis* (Manjón & Moreno) Hjortstam et al., Mycotaxon 33: 257. 1988 ≡*Dendrothele canariensis* (Manjón & Moreno) Hjortstam, Mycotaxon 54: 185. 1995.

Material studied.–Menorca (Mn): Mahón, Alayor, Son Bou, 31SEE9117, on *Phoenix canariensis*, J. Cardoso & I. Melo, 16-XI-1990, 5192I.Melo.

Recently, HJORTSTAM (1995: 185) assigned this taxon to *Dendrothele*, based on its similarity with *D. griseocanna* (Bres.) H. Bourdot & Galzin. Previously the species was described in *Cerocorticium* and then in *Epithele*. There seems to be agreement on its affinities.

It is quite clear that the species is not an *Epithele*, considering that the teeth are fertile and not tufts of sterile hyphae, as happens in *Epithele*. The presence of pleurobasidia excludes it from *Dendrothele*, a genus with a characteristic catahymenium, thick-walled spores and sterile papillae.

The presence of pleurobasidia, thin-walled, smooth and non-amyloid spores, and fertile teeth led as to first think of *Aphanobasidium* Jülich. Taking into account the works of OBERWINKLER (1977), JÜLICH (1979), HJORTSTAM & LARSSON (1987) and BOIDIN & GILLES (1989), we decided to follow the integrated criterion of HJORTSTAM & LARSSON (1987) and interpret *Phlebiella* P. Karst. in a broad sense, as was already done by HJORTSTAM & LARSSON (1994). This decision leads to the following nomenclatural proposals:

Phlebiella albida (Hauerslev) Tellería, Melo & Dueñas, **comb. nov**.

≡*Xenasmatella albida* Hauerslev, Friesia 11: 332. 1987

Phlebiella boidinii Tellería, Melo & Dueñas, **nom. & comb. nov**.

≡*Aphanobasidium sphaerosporum* Boidin & Gilles, Cryptog. Bot. 1: 75. 1989 non *Phlebiella sphaerospora* (Maire) Bondartsev & Singer, Trut. griby: 51. 1953.

Phlebiella bourdotii (Boidin & Gilles) Tellería, Melo & Dueñas, **comb. nov.**

≡*Aphanobasidium bourdotii* Boidin & Gilles, Cryptog. Bot. 1: 74. 1989.

Phlebiella pruina (H. Bourdot & Galzin) Tellería, Melo & Dueñas, **comb. nov.**
≡*Corticium pruinum* H. Bourdot & Galzin, Hym. France: 224. 1928

Phlebiopsis gigantea (Fr.: Fr.) Jülich

Material studied.–Menorca (Mn): Mercadal, Binifamis, 31SFE0128, 60 m.s.m., on *Pinus halepensis*, J. Cardoso & I. Melo, 16-XI-1990, 5049I.Melo.

Phlebiopsis ravenelii (Cooke) Hjortstam

Material studied.–Menorca (Mn): Ciutadella, La Vall, 31TEE8033, 20 m.s.m., on *Erica* sp., J. Cardoso & I. Melo, 17-XI-1990, 5248I.Melo; ibidem, on *Quercus ilex*, 17-XI-1990, 5233I.Melo; idem, 5242I.Melo. Mercadal, Santa Eulalieta, 31SEE9725, 120 m.s.m., on *Arbutus unedo*, J. Cardoso & I. Melo, 16-XI-1990, 5171I.Melo; ibidem, on *Quercus ilex*, M.T. Tellería, 16-XI-1990, 10748Tell.; idem, 5160I.Melo. Mercadal, Binifamis, 31SFE0128, 60 m.s.m., on *Quercus ilex*, M. Dueñas, 15-XI-1990, 5681M.D.

Pulcherricium caeruleum (Schrad.: Fr.) Parmasto

Material studied.–Menorca (Mn): Mercadal, Binifamis, 31SFE0128, 60 m.s.m., on *Quercus ilex*, J. Cardoso & I. Melo, 15-XI-1990, 5066I.Melo.

***Punctularia subhepatica** (Berk.) Hjortstam

Material studied.–Menorca (Mn): Mercadal, Binifamis, 31SFE0128, 60 m.s.m., on *Ficus carica*, M. Dueñas, 15-XI-1990, 5698M.D.

Radulomyces confluens (Fr.: Fr.) M.P. Christ.

Material studied.–Menorca (Mn): Mercadal, Cala Tirant, 31TEE9333, on *Tamarix* sp., J. Cardoso & I. Melo, 16-XI-1990, 5176I.Melo; idem, 5186I.Melo; idem, 10805Tell.; idem, 5776M.D.; idem, 5778bisM.D.; idem, 5781M.D.

***Radulomyces molaris** (Chaill.: Fr.) M.P. Christ.

Material studied.–Menorca (Mn): Mercadal, Binifamis, 31TFE0128, 60 m.s.m., on *Quercus ilex*, M. Dueñas, 15-XI-1990, 5666M.D.

***Schizopora radula** (Pers.: Fr.) Hallenb.

Material studied.–Menorca (Mn): Ciutadella, La Vall, 31TEE8033, 20 m.s.m., on *Quercus ilex*, J. Cardoso & I. Melo, 17-XI-1990, 5222I.Melo; idem, 5816M.D. Mercadal, Santa Eulalieta, 31SEE9725, 120 m.s.m., on *Pinus halepensis*, J. Cardoso & I. Melo, 16-XI-1990, 5139I.Melo.

***Scytinostroma galactinum** (Fr.) Donk

Material studied.–Menorca (Mn): Mercadal, Binifamis, 31SFE0128, 60 m.s.m., on unident. wood, J. Cardoso & I. Melo, 15-XI-1990, 5083I.Melo.

Scytinostroma mediterraneense Boidin & Lanquetin

Material studied.–Menorca (Mn): Mercadal, Binifamis, 31SFE0128, 60 m.s.m., on *Ficus carica*, M.T. Tellería, 15-XI-1990, 10685Tell.

Skeletocutis nivea (Jungh.) Jean Keller

Material studied.–Menorca (Mn): Mercadal, Santa Eulalieta, 31SEE9725, 120 m.s.m., on *Arbutus unedo*, M. Dueñas, 16-XI-1990, 5734M.D.; idem, 5744M.D. Mercadal, Binifamis, 31SFE0128, 60 m.s.m., on *Quercus ilex*, J. Cardoso & I. Melo, 15-XI-1990, 5089I.Melo.

Skeletocutis percandida (Malençon & Bertault) Jean Keller

Material studied.–Menorca (Mn): Ciutadella, La Vall, 31TEE8033, 20 m.s.m., on *Erica* sp., J. Cardoso & I. Melo, 17-XI-1990, 5244I.Melo; ibidem, on *Pinus halepensis*, 17-XI-1990, 5231I.Melo; idem, 5803M.D.

Steccherinum ochraceum (Pers.: Fr.) S.F. Gray

Material studied.–Menorca (Mn): Mercadal, Binifamis, 31SFE0128, 60 m.s.m., on *Quercus ilex*, M. Dueñas, 15-XI-1990, 5667M.D.

Stereum hirsutum (Willd.: Fr.) S.F. Gray

Material studied.–Menorca (Mn): Ciutadella, La Vall, 31TEE8033, 20 m.s.m., on *Quercus ilex*, M.T. Tellería, 17-XI-1990, 5827M.D.; idem, 5236I.Melo. Mercadal, Santa Eulalieta, 31SEE9725, 120 m.s.m., on *Quercus ilex*, M.T. Tellería, 16-XI-1990, 10780Tell.

***Subulicystidium longisporum** (Pat.) Parmasto

Material studied.–Menorca (Mn): Ciutadella, La Vall, 31TEE8033, 20 m.s.m., on *Quercus ilex*, M.T. Tellería, 17-XI-1990, 10848Tell.; idem, 5249I.Melo.

***Tomentella bresadolae** (Bres.) Höhn. & Litsch.

Material studied.–Menorca (Mn): Ciutadella, La Vall, 31TEE8033, 20 m.s.m., on *Olea europaea*, M. Dueñas, 17-XI-1990, 5835M.D.

***Tomentella neobourdotii** Larsen

Material studied.–Menorca (Mn): Mercadal, sand dunes of Son Saura, 31TEE9932, s. l., on *Pinus halepensis*, M. Dueñas, 15-XI-1990, 5711M.D.

***Tomentella ramosissima** (Berk. & M.A. Curtis) Wakef.

Material studied.–Menorca (Mn): Mercadal, Santa Eulalieta, 31SEE9725, 120 m.s.m., on *Arbutus unedo*, M. Dueñas, 16-XI-1990, 5731M.D.

***Tomentella rubiginosa** (Bres.) Maire

Material studied.–Menorca (Mn): Mercadal, Binifamis, 31SFE0128, 60 m.s.m., on *Quercus ilex*, M. Dueñas, 15-XI-1990, 5700M.D.

***Tomentellastrum badium** (Link) Larsen

Material studied.–Menorca (Mn): Mercadal, Santa Eulalieta, 31SEE9725, 120 m.s.m., on *Arbutus unedo*, M. Dueñas, 16-XI-1990, 5735M.D.

Tomentellina fibrosa (Berk. & M.A. Curtis) Larsen

Material studied.–Menorca (Mn): Mahón, S'Albufera, 31SFE0823, s. l., on *Rosmarinus officinalis*, J. Cardoso & I. Melo, 15-XI-1990, 5118I.Melo. Mercadal, Santa Eulalieta, 31SEE9725, 120 m.s.m., on *Pinus halepensis*, J. Cardoso & I. Melo, 16-XI-1990, 5135I.Melo. Mercadal, sand dunes of Son Saura, 31TEE9932, s. l., on *Pistacia lentiscus*, M. Dueñas, 15-XI-1990, 5710M.D.

Trechispora cohaerens (Schwein.) Jülich & Stalpers

Material studied.–Menorca (Mn): Ciutadella, La Vall, 31TEE8033, 20 m.s.m., on *Pinus halepensis*, 17-XI-1990, M.T. Tellería, 10821Tell.; idem, 10822Tell.; idem, 10815Tell.

Trechispora farinacea (Pers.: Fr.) Liberta, s.l.

Material studied.–Menorca (Mn): Ciutadella, La Vall, 31TEE8033, 20 m.s.m., on *Pinus halepensis*, M. Dueñas, 17-XI-1990, 5811M.D.; ibidem, on *Quercus ilex*, J.

Cardoso & I. Melo, 17-XI-1990, 5204I.Melo; idem, 5210I.Melo. Mahón, Alayor, Son Bou, 31SEE9117, s. l., on *Phoenix canariensis*, J. Cardoso & I. Melo, 16-XI-1990, 5191I.Melo; idem, 5787M.D. Mercadal, Binifamis, 31SFE0128, on *Pinus halepensis*, M.T. Tellería, 15-XI-1990, 10680Tell.; idem, 10681Tell.; idem, 5060I.Melo; idem, 5684M.D.; idem, 5692M.D.; ibidem, on *Quercus ilex*, J. Cardoso & I. Melo, 15-XI-1990, 5041I.Melo; idem, 5064I.Melo; idem, 5076I.Melo; idem, 5073I.Melo. Mercadal, Santa Eulalieta, 31SEE9725, 120 m.s.m., on *Arbutus unedo*, M. Dueñas, 16-XI-1990, 5739M.D.; ibidem, on *Pinus halepensis*, M.T. Tellería, 16-XI-1990, 10738Tell.; ibidem, on *Quercus ilex*, M.T. Tellería, 16-XI-1990, 10790Tell.

***Trechispora microspora** (P. Karst.) Liberta

Material studied.–Menorca (Mn): Mercadal, Binifamis, 31SFE0128, 60 m.s.m., on unident. wood, J. Cardoso & I. Melo, 15-XI-1990, 5070I.Melo.

***Trechispora stellulata** (H. Bourdot & Galzin) Liberta

Material studied.–Menorca (Mn): Ciutadella, La Vall, 31TEE8033, 20 m.s.m., on *Quercus ilex*, J. Cardoso & I. Melo, 17-XI-1990, 5230I.Melo. Mahón, S'Albufera, 31SFE0823, on unident. wood, J. Cardoso & I. Melo, 15-XI-1990, 5122I.Melo.

***Tubulicium vermiferum** (H. Bourdot) Oberw.

Material studied.–Menorca (Mn): Ciutadella, La Vall, 31TEE8833, 20 m.s.m., on *Quercus ilex*, M.T. Tellería, 17-XI-1990, 10282Tell.

***Tubulicrinis calothrix** (Pat.) Donk

Material studied.–Menorca (Mn): Mercadal, Santa Eulalieta, 31SEE9725, 120 m.s.m., on *Pinus halepensis*, J. Cardoso & I. Melo, 16-XI-1990, 5127I.Melo; idem, 5128I.Melo; idem, 5130I.Melo. Mercadal, Binifamis, 31SFE0128, 60 m.s.m., on *Pinus halepensis*, J. Cardoso & I. Melo, 15-XI-1990, 5055I.Melo; idem, 5056I.Melo.

Tubulicrinis gracillimus (Ell. & Ev. ex D.P. Rogers & Jackson) G. Cunn.

Material studied.–Menorca (Mn): Mercadal, Binifamis, 31SFE0128, 60 m.s.m., on *Pinus halepensis*, J. Cardoso & I. Melo, 15-XI-1990, 5058I.Melo.

***Tubulicrinis incrassatus** Hallenberg

Material studied.–Menorca (Mn): Mercadal, Santa Eulalieta, 31SEE9725, 20 m.s.m., on *Pinus halepensis*, M.T. Tellería, 16-XI-1990, 10741Tell.

***Vuilleminia comedens** (Nees: Fr.) Maire

Material studied.–Menorca (Mn): Ciutadella, La Vall, 31TEE8033, 20 m.s.m., on *Quercus ilex*, M.T. Tellería, 17-XI-1990, 10823Tell. Mercadal, Santa Eulalieta, 31SEE9725, 120 m.s.m., on *Quercus ilex*, J. Cardoso & I. Melo, 16-XI-1990, 5168I.Melo. Mercadal, Binifamis, 31SFE0128, 60 m.s.m., on *Quercus ilex*, J. Cardoso & I. Melo, 15-XI-1990, 5063I.Melo; idem, 5087I.Melo.

***Vuilleminia macrospora** (Bres.) Hjortstam

Material studied.–Menorca (Mn): Mercadal, Cala Tirant, 31TEE9333, s. l., on *Tamarix* sp., J. Cardoso & I. Melo, 16-XI-1990, 5181I.Melo.

***Vuilleminia megalospora** Bres.

Material studied.–Menorca (Mn): Mercadal, Binifamis, 31SFE0128, 60 m.s.m., on *Quercus ilex*, J. Cardoso & I. Melo, 15-XI-1990, 5062I.Melo.

TABLE 2
THE COMPLETE CATALOGUE BASED ON ORIGINAL AND BIBLIOGRAPHIC DATA

Species	Mallorca (Mll)	Menorca (Mn)	Ibiza (Ib)	Formentera (Fo)	Cabrera (PM)
Abortiporus biennis (Bull.: Fr.) Singer	♣				
*Acanthophysium dextrinoideocerussatum (Manjón et al.) Tellería		♣			
A. minor (Pilát) Tellería	♣				
Adustomyces lusitanicus (Torrend) Jülich	♣				
Amphinema byssoides (Pers.: Fr.) J. Erikss.	♣	♣			
*Antrodia albidoides David & Dequatre		♣			
*A. ramentacea (Berk. & A. Braun) Donk		♣			
A. serialis (Fr.) Donk					♣
*A. sinuosa (Fr.) P. Karst.		♣			
Asterostroma gaillardii Pat.	♣	♣			
Athelia arachnoidea (Berk.) Jülich	♣				
*A. decipiens (Höhn. & Litsch.) J. Erikss.		♣			
A. epiphylla Pers.	♣				
Auriculariopsis ampla (Lév.) Maire	♣				
Bjerkandera adusta (Willd.: Fr.) P. Karst.	♣				
Boidinia peroxydata (Rick) Hjortstam & Ryvarden		♣			
Boletopsis leucomelaena (Pers.) Fayod	♣	♣	♣		
*Botryobasidium botryosum (Bres.) J. Erikss.		♣			
*Botryohypochnus isabellinus (Fr.) J. Erikss.		♣			
*Brevicellicium olivascens (Bres.) Larsson & Hjortstam		♣			
Ceratobasidium cornigerum (H. Bourdot) D.P. Rogers	♣				
*Ceriporia viridans (Berk. & A. Braun) Donk		♣			
Coniophora arida (Fr.) P. Karsten var. arida	♣	♣			
C. arida var. suffocata (Peck) Ginns	♣				
C. olivacea (Fr.: Fr.) P. Karst.	♣				
C. puteana (Schumacher: Fr.) P. Karst.	♣				
Coriolopsis gallica (Fr.) Ryvarden	♣		♣		
Corticium roseum Pers.: Fr.	♣				
Crustoderma dryinum (Berk. & M.A. Curtis) Parmasto	♣	♣			
Cystostereum subabruptum (H. Bourdot & Galzin) J. Erikss. & Ryv.	♣				
Daedalea quercina L.: Fr.		♣			
*Dendrocorticium polygonioides (P. Karst.) M.J. Larsen & Gilb.		♣			
Dichomitus campestris (Quél.) Domański & Orlos	♣	♣			
D. squalens (P. Karst.) Reid		♣			
Duportella malenconii (Boidin & Lanquetin) Hjortstam		♣			
Fibriciellum sylvae-ryae J. Erikss. & Ryvarden		♣			
Fistulina hepatica (Schaeff.: Fr.) Fr.	♣				
Fomes fomentarius (L.: Fr.) J.J. Kickx	♣	♣			
Fomitopsis pinicola (Sw.: Fr.) P. Karst.	♣		♣		
Ganoderma australe (Fr.) Pat.			♣		
G. applanatum (Pers.) Pat.	♣				
G. lucidum (Curtis: Fr.) P. Karst.	♣	♣			

TABLE 2 (CONTINUATION)

Species	Mallorca (Mll)	Menorca (Mn)	Ibiza (Ib)	Formentera (Fo)	Cabrera (PM)
*Gloeocystidiellum olivaceo-album (H. Bourdot & Galzin) Tellería		♣			
Gloeophyllum abietinum (Bull.: Fr.) P. Karst.		♣	♣		
Gl. sepiarium (Wulfen: Fr.) P. Karst.	♣				
Gl. trabeum (Pers.: Fr.) Murrill	♣		♣		
Hexagonia nitida Durieu & Mont.	♣				
Hymenochaete cinnamomea (Pers.) Bres.		♣			
H. rubiginosa (Dicks.: Fr.) Lév.	♣				
*Hyphoderma medioburiense (Burt) Donk		♣			
H. pallidum (Bres.) Donk		♣			
H. praetermissum (P. Karst.) J. Erikss. & Strid	♣	♣			♣
*H. puberum (Fr.) Wallr.		♣			
*Hyphodermella corrugata (Fr.) J. Erikss. & Ryvarden		♣			
Hyphodontia alutaria (Burt) J. Erikss.	♣				
H. arguta (Fr.) J. Erikss.	♣				
*H. aspera (Fr.) J. Erikss.		♣			
H. bugellensis (Ces.) J. Erikss.	♣				
H. crustosa (Pers.: Fr.) J. Erikss.		♣			♣
*H. juniperi (H. Bourdot & Galzin) J. Erikss.		♣			
H. sambuci (Pers.) J. Erikss.	♣	♣			
*H. subalutacea (P. Karst.) J. Erikss. var. subalutacea		♣			
*H. subalutacea var. floccosa (H. Bourdot & Galzin) Tellería & Melo		♣			
H. stipata (Fr.) Gilb.	♣				
*Hypochnicium sphaerosporum (Höhn. & Litsch.) J. Erikss.		♣			
*Inonotus cuticularis (Bull.: Fr.) P. Karst.		♣			
I. dryadeus (Pers.: Fr.) Murrill		♣			
I. hispidus (Bull.: Fr.) P. Karst.			♣		
I. tamaricis (Pat.) Maire	♣	♣			
Laetiporus sulphureus (Bull.: Fr.) Murrill	♣				
*Lagarobasidium detriticum (H. Bourdot & Galzin) Jülich		♣			
*Laxitextum bicolor (Pers.: Fr.) Parmasto		♣			
Lenzites betulinus (L.: Fr.) Fr.	♣				
*Litschauerella clematitis (H. Bourdot & Galzin) J. Erikss. & Ryvarden		♣			
Lopharia spadicea (Pers.: Fr.) Boidin			♣		
Meruliopsis corium (Pers.: Fr.) Ginns	♣	♣			
*M. hirtellus (Burt) Ginns		♣			
Merulius tremellosus Fr.	♣				
*Mycoacia aurea (Fr.) J. Erikss. & Ryvarden		♣			
*M. fuscoatra (Fr.: Fr.) Donk		♣			
*Oligoporus inocybe (David & Malençon) Gilb. & Ryvarden		♣			
O. leucomallelus (Murrill) Gilb. & Ryvarden	♣	♣	♣		
O. tephroleucus (Fr.) Gilb. & Ryvarden		♣			
Oxyporus populinus (Schumach.: Fr.) Donk	♣				
**Parmastomyces transmutans (Overh.) Ryvarden & Gilb.		♣			

SEE ERRATA

Table 2 (Continuation)

Species	Mallorca (Mll)	Menorca (Mn)	Ibiza (Ib)	Formentera (Fo)	Cabrera (PM)
**Peniophora boidinii Reid		♣			
P. cinerea (Pers.: Fr.) Cooke	♣				
P. incarnata (Pers.: Fr.) P. Karst.	♣				
P. lycii (Pers.: Fr.) Höhn. & Litsch.		♣		♣	♣
P. meridionalis Boidin	♣[1]	♣			
P. quercina (Pers.: Fr.) Cooke	♣	♣			
P. reidii Boidin & Lanquetin		♣			♣
**P. rufomarginata (Pers.) Litsch.		♣			
*P. tamaricicola Boidin & Malençon		♣			
P. versicolor (Bres.) Sacc. & Sydow	♣	♣			
*Perenniporia ochroleuca (Berk.) Ryvarden		♣	♣		
*P. rosmarini David & Malençon		♣			
Phaeolus schweinitzii (Fr.) Pat.	♣		♣		
*Phanerochaete deflectens (P. Karst.) Hjortstam		♣			
Ph. galactites (Bres.) J. Eriksson & Ryvarden			♣[2]		
Ph. martelliana (Bres.) J. Erikss. & Ryvarden	♣	♣			
*Ph. sanguinea (Fr.) Pouzar		♣			
*Ph. sordida (P. Karst.) J. Erikss. & Ryvarden		♣			
Ph. tamariciphila Boidin et al.		♣			
**Ph. xerophila Burdsall		♣			
**Phellinus erectus David et al.		♣			
*Ph. ferreus (Pers.) H. Bourdot & Galzin		♣			
*Ph. ferruginosus (Schrad.: Fr.) Pat.		♣			
Ph. igniarius (L.: Fr.) Quél.	♣				
Ph. pini (Fr.) A. Ames	♣		♣		
Ph. pomaceus (Pers.) Maire			♣		
Ph. punctatus (P. Karst.) Pilát		♣			
Ph. robustus (P. Karst.) H. Bourdot & Galzin		♣	♣		
Ph. torulosus (Pers.) H. Bourdot & Galzin	♣	♣	♣		
Ph. tuberculosus (Baumg.) Niemelä	♣	♣	♣		
*Phlebia livida (Pers.: Fr.) Bres.		♣			
*Ph. subochracea (Bres.) J. Erikss. & Ryvarden		♣			
*Ph. subserialis (H. Bourdot & Galzin) Donk		♣			
*Phlebiella canariensis (Manjón & Moreno) Tellería et al.		♣			
Phlebiopsis gigantea (Fr.: Fr.) Jülich	♣	♣			
Ph. ravenelii (Cooke) Hjortstam	♣[3]	♣			
Phylloporia ribis (Schumach.: Fr.) Ryvarden			♣	♣	♣
Polyporus arcularius Batsch.: Fr.	♣	♣			
P. brumalis Pers.: Fr.	♣				
P. meridionalis (A. David) H. Jahn	♣		♣		♣
P. tuberaster Jacq.: Fr.	♣				
Pseudotomentella tristis (P. Karst.) Larsen	♣				

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[1] According to Tellería [in Tellería (ed.) 1991b: 113] a specimen of *P. versiformis* (Berk. & M.A. Curtis) H. Bourdot & Galzin reported by Tellería (1980: 152) from Mallorca (Mll) should be assigned to *P. meridionalis* Boidin.

[2] We doubt on the record reported (cf. Malençon & Bertault, 1972: 33) from Menorca until having studied the voucher specimen, since it probably belongs to *Ph. tamariciphila* Boidin (cf. Tellería et al., 1997).

[3] Malençon & Bertault (1972: 27) reported *Phlebia flavido-alba* (Cooke) Malençon & Bertault from Mallorca (Mll), a very close to *Ph. ravenelii* on the basis of morphological characters. More accurate studies, including those of nomenclatural types, are needed to clarify its taxonomic position. We will keep provisionally the citation of Malençon & Bertault (l.c.) sub *Ph. ravenelii*.

TABLE 2 (CONTINUATION)

Species	Mallorca (Mll)	Menorca (Mn)	Ibiza (Ib)	Formentera (Fo)	Cabrera (PM)
Pulcherricium caeruleum (Schrad.: Fr.) Parmasto	♣	♣			
*Punctularia subhepatica (Berk.) Hjortstam		♣			
Pycnoporus cinnabarinus (Jacq.: Fr.) P. Karst.	♣				
Radulomyces confluens (Fr.: Fr.) M.P. Christ.		♣			♣
*R. molaris (Chaill.: Fr.) M.P. Christ.		♣			
Resinicium pinicola (J. Erikss.) J. Erikss. & Hjortstam		♣			
Rigidoporus ulmarius (Sowerby: Fr.) Imazeki	♣				
*Schizopora radula (Pers.: Fr.) Hallenb.		♣			
*Scytinostroma galactinum (Fr.) Donk		♣			
S. mediterraneense Boidin & Lanquetin		♣			
Serpula himantioides (Fr.: Fr.) P. Karst.	♣				
Skeletocutis lenis (P. Karst.) Niemelä	♣				
Sk. nivea (Jungh.) Jean Keller	♣	♣			
Sk. percandida (Malençon & Bertault) Jean Keller	♣	♣			
Steccherinum ochraceum (Pers.: Fr.) S.F. Gray	♣	♣			
Stereum gausapatum (Fr.) Fr.	♣				
St. hirsutum (Willd.: Fr.) S.F. Gray	♣	♣	♣		♣
St. ochraceoflavum (Schwein.) Ellis	♣				
St. rugosum (Pers.: Fr.) Fr.	♣				
St. sanguinolentum (Alb. & Schwein.: Fr.) Fr.	♣				
*Subulicystidium longisporum (Pat.) Parmasto		♣			
*Tomentella bresadolae (Bres.) Höhnel & Litsch		♣			
T. bryophila (Pers.) Larsen	♣				
T. crinalis (Fr.) Larsen	♣				
*T. neobourdotii Larsen		♣			
*T. ramosissima (Berk. & M.A. Curtis) Wakef.		♣			
*T. rubiginosa (Bres.) Maire		♣			
*Tomentellastrum badium (Link) Larsen		♣			
Tomentellina fibrosa (Berk. & M.A. Curtis) Larsen	♣	♣			
Trametes hirsuta (Fr.) Pilát	♣				
T. ljubarski Pilát			♣		
T. suaveolens (L.: Fr.) Fr.	♣				
T. versicolor (L.: Fr.) Pilát	♣				
Trechispora cohaerens (Schwein.) Jülich & Stalpers	♣	♣			
T. farinacea (Pers.: Fr.) Liberta, s.l.	♣	♣			
*T. microspora (P. Karst.) Liberta		♣			
*T. stellulata (H. Bourdot & Galzin) Liberta		♣			
Trichaptum abietinum (Dicks.: Fr.) Ryvarden	♣				
T. fusco-violaceus (Ehrenb.: Fr.) Ryvarden	♣	♣			
*Tubulicium vermiferum (H. Bourdot) Oberw.		♣			
*Tubulicrinis calothrix (Pat.) Donk		♣			
T. gracillimus (Ell. & Ev. ex D.P. Rogers & Jackson) G. Cunn.		♣			♣
*T. incrassatus Hallenberg		♣			
T. sororius (H. Bourdot & Galzin) Oberw.	♣				
Vararia cremeoavellanea Pouzar		♣			
*Vuilleminia comedens (Nees: Fr.) Maire		♣			
*V. macrospora (Bres.) Hjortstam		♣			
*V. megalospora Bres.		♣			
Xenasma pruinosum (Pat.) Donk	♣				

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SCUTELLOSPORA PERSICA (GLOMALES, ZYGOMYCETES), AN ARBUSCULAR MYCORRHIZAL FUNGUS NEW TO THE MYCOTA OF POLAND

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Abstract

Morphological properties of spores of *Scutellospora persica* are described and illustrated. This fungus was recovered from the root zone of *Ammophila arenaria* and *Petasites spurius* colonizing maritime sand dunes adjacent to Świnoujście in northwestern Poland. *Scutellospora persica* produces spores singly in the soil. The greyish orange to tomato red spores are globose to subglobose, (270–)337(–435) µm diam or occasionally ovoid, 320–390 x 365–450 µm and have two walls: a spore wall and an inner wall, each consisting of two layers. The diagnostic feature of *S. persica* is its outer spore wall layer being ornamented with very small warts. This fungus produced spores and arbuscular mycorrhizae in single–species pot cultures with *Plantago lanceolata* and *Sorghum vulgare*. *Scutellospora persica* was for the first time found in Poland which is the second country in Europe where the occurrence of this fungus was so far recorded.

***Key Words*:** Glomales, *Scutellospora persica*, occurrence, Poland, Zygomycetes

Introduction

Scutellospora persica (Koske & Walker) Walker & Sanders has originally been described as producing pale pinkish–orange to brownish–orange spores with three walls arranged in two groups, A and B (Koske and Walker, 1985). According to Koske and Walker (1985), group A consists of a warted wall adherent to a laminated wall. Group B forms a single, membranous wall.

Ontogenetic studies conducted by Morton (1995) showed that the inner wall of *S. persica* spores is composed of two, usually tightly adherent layers, of which the inner one is consistently thicker than the outer layer. Additionally, the spores investigated by Morton (1995) were much darker than those described by Koske and Walker (1985).

During investigations of the occurrence of arbuscular mycorrhizal fungi in maritime sand dunes adjacent to Świnoujście (53°55'N, 14°14'E) in northwestern Poland, spores of *S. persica* were found. The aim of this paper is to describe and illustrate these spores, as well as to present the distribution of *S. persica* in the world.

Materials and methods

Roots and attached soil of sample plants were collected from a depth of 5–30 cm, air dried for 2 weeks, and subsequently refrigerated at 4 C until processing. Trap cultures were established from the field–collected mixture of soil and roots placed in two 15–cm plastic pots (1350 cm^3). One pot was seeded with *Plantago lanceolata* L. and the second with *Sorghum sudanense* (Staph.) Piper. Plants were grown in a greenhouse at 18–30 C with supplemental 16–h lighting provided by one SON–T AGRO sodic lamp (Philips Lighting Poland S. A.) placed 1 m above pots. The maximum light intensity was 180 $\mu E\ m^{-2}s^{-1}$ at pot level. Plants were watered with tap water 2–3 times a week. Trap cultures were harvested after five to twelve months, spores extracted by wet sieving and decanting (Gerdemann and

Nicolson, 1963), roots stained in 0.05% trypan blue (Phillips and Hayman, 1970), and examined for the presence of mycorrhizae.

Establishment of single–species pot cultures was made by placement of up to 50 newly formed spores on roots of 10–14–day old seedlings of *P. lanceolata* and *Sorghum vulgare* Pers. The plants were grown in 8–cm plastic pots (250 cm^3) for four to twelve months. The growth medium was an autoclaved sand from maritime dunes adjacent to Świnoujście (pH 6.7, 12 and 26 mg L^{-1} P and K, respectively).

Morphological investigations were conducted based on at least 100 spores mounted in polyvinyl alcohol/lactic acid/glycerol, PVLG (Koske and Tessier, 1983) and 50 spores in PVLG with Melzer's reagent (1:1, v/v). Specimens for scanning electron microscopy were fixed in 3% glutaraldehyde in 0.02 M phosphate buffer (pH 6). They were then dehydrated in a graded ethanol series: 30, 50, 80 and 100%, critical point dried, mounted on aluminum stubs, and coated with gold. Wall characteristics of spores and terminology are those suggested by Franke and Morton (1994), Spain *et al.* (1989), and Walker (1983). Spore color was determined under a dissecting microscope on fresh specimens immersed in water. Color names are from Kornerup and Wanscher (1983). Specimens have been preserved on slides mounted in PVLG and deposited in the Department of Plant Pathology (DPP), Academy of Agriculture, Szczecin, Poland. Nomenclature of fungi used here follows Walker and Trappe (1993). The classification is that of Morton and Benny (1990).

Description and discussion

Scutellospora persica (Koske & Walker) Walker & Sanders

Figs. 1–8

Spores formed singly in the soil; terminally or subterminally on a bulbous sporogenous cell (Figs. 1, 2, 6); greyish orange (6B6) to tomato red (8C8); globose to subglobose; (270–)337(–435) μm diam; sometimes ovoid; 320–390 x 365–450 μm.

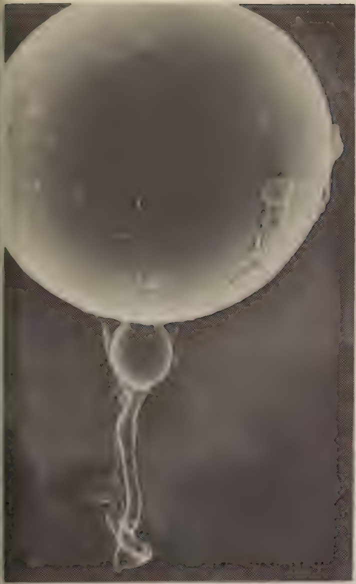
Spores with two walls (Figs. 3, 6), a spore wall and an inner wall, each consisting of two layers (layers 1 and 2). Outer spore wall layer 1 (Figs. 4–6), forming the spore surface, rigid, hyaline to light yellow (4A4), (0.4–)0.5(–0.9) μm thick (excluding the warts), usually tightly adherent to spore wall layer 2, ornamented with warts 0.3–0.5 μm high, 0.5 μm wide at their base, usually evenly distributed on layer 1, sometimes absent on a part of the spore surface. Layer 2 laminated, greyish orange (6B6) to tomato red (8C8), (7.0–)8.1(–9.8) μm thick. Inner wall layers 1 and 2 flexible, hyaline, 0.5–0.7 μm and 1.2–1.4 μm thick, respectively (Figs. 3, 6).

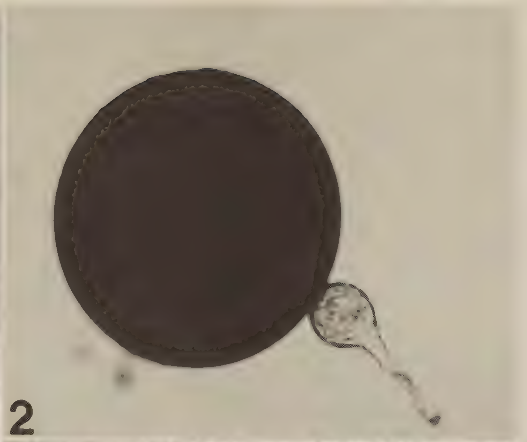
Spore contents of hyaline oil droplets.

Sporogenous cell (Figs. 1, 2, 6) borne terminally on a sparsely septate sporophore; ovoid to clavate; (60.0–)69.4(–80.0) μm broad, concolorous with spore wall layer 2; walls (4.7–)5.4(–6.1) μm thick at the spore base, thinning distally to 1–2 μm. A hyphal peg up to 57 μm long x 5 μm wide usually arises from the sporogenous cell and projects towards the spore base. *Sporophore* formed of a hyaline to light orange (5A4) septate hypha, 8.4–10.0 μm diam; walls 1.0–2.2 μm thick; hypha simple with a single sporogenous cell.

Germination shield hyaline to yellowish white (4A2), cardioid; 100–150 x 200–220 μm, ornamented with straight and Y–shaped ridges at the margin and with arched with branches ridges surrounding germ tube initials (Fig. 7); formed between spore wall layer 2 and inner wall layer 1. One to seven, hyaline to yellowish white (4A2), 5.0–7.5 μm diam germ tubes emerge from the germination shield.

Figs. 1–5. *Scutellospora persica.* **1** and **2**. Single spores with bulbous sporogenous cell. Scanning electron microscopy (SEM) and bright–field microscopy (BFM), respectively, x131 and x104, respectively. **3**. Spore wall and inner wall layers 1 (iwl1) and 2 (iwl2) of a crushed spore are visible. Differential interference contrast (DIC), x367. **4** and **5.** Spore surface ornamented with warts. SEM and DIC, respectively, x922 and x558, respectively.





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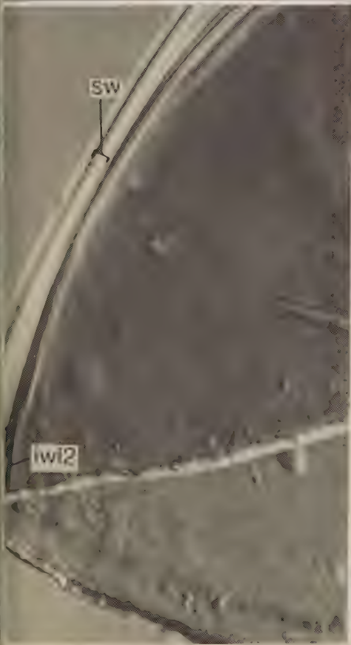

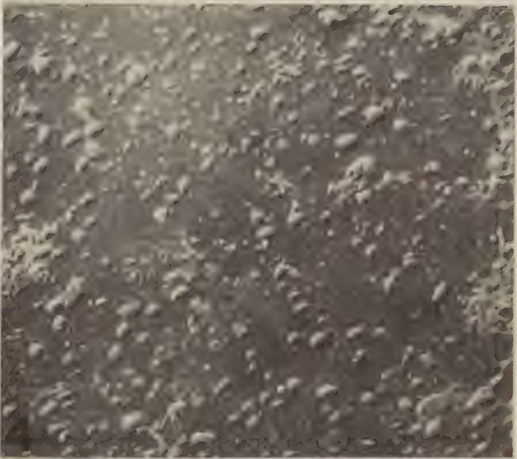

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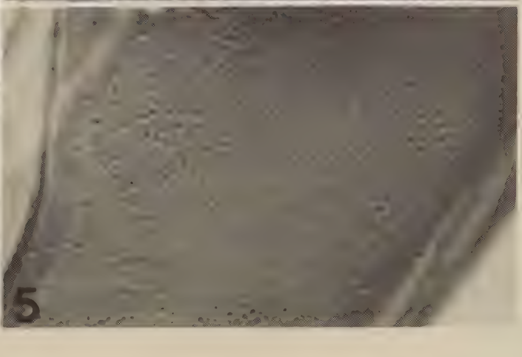

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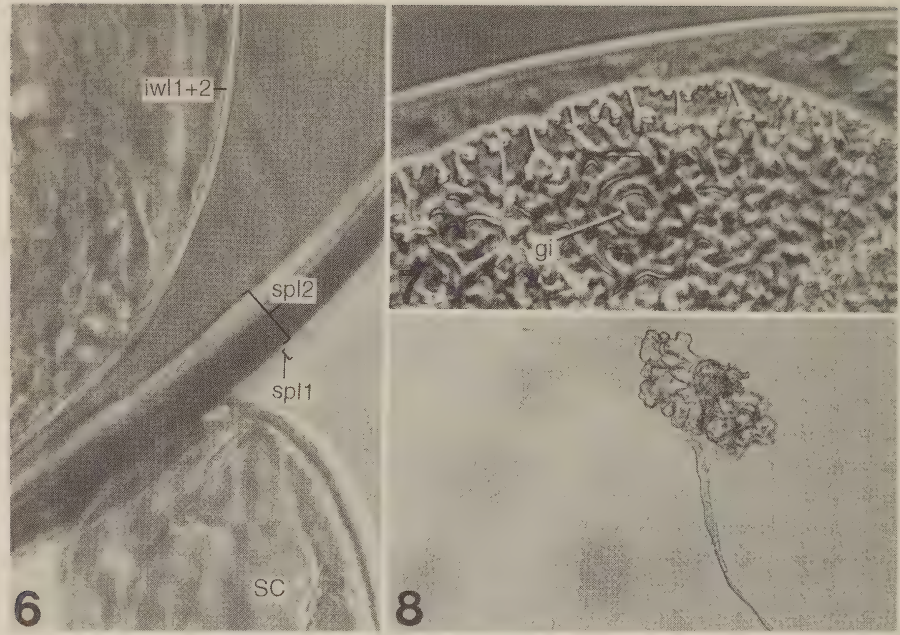

Figs. 6–8. *Scutellospora persica*. **6**. Spore wall layers 1 (spl1) and 2 (spl2), as well as adherent inner wall layers 1 and 2 (iwl 1+2) and sporogenous cell (SC) are seen. DIC, x558. **7**. Ornamented germination shield with germ tube initial (gi). DIC, x397. **8**. Auxiliary cells. BFM, x476.

Auxiliary cells (Fig. 8) borne in soil singly or in clusters of 2–7; hyaline; lobed to irregular; 5.0–7.5 x 8.0–22.5 µm; with knobby projections; produced on coiled hyphae, 1.8–2.5 µm diam, concolorous with auxiliary cells.

COLLECTION EXAMINED. Poland. Świnoujście, found in the root zone of *Ammophila arenaria* Link and *Petasites spurius* (Retz.) Rchb, 6 Oct. 1993, *Błaszkowski J. 2092–2107* (DPP); from trap and single–species cultures with *P. lanceolata* and *S. sudanense* established based on soils collected from under the plants mentioned above, *Błaszkowski J., unnumbered collection* (DPP).

OTHER MATERIAL EXAMINED. USA. Long Beach, New Jersey, under *Solidago sempervirens* L., 13 March 1982, *Walker C. 649–1, 649–2* (isotypes); Greece. Veriko, among roots of *A. arenaria*, 16 Sept. 1995, *Tadych M., unnumbered collection* (DPP).

DISTRIBUTION AND HABITAT. *Scutellospora persica* was recovered from the root zone of only two plant species colonizing maritime sand dunes adjacent to Świnoujście (53°55'N, 14°14'E). Spore populations of arbuscular fungi recovered from 337 soil samples collected at 25 other maritime dune sites (Błaszkowski, 1993b) and from 61 soils coming from two inland dune areas (Błaszkowski, unpubl.) did not contain *S. persica* spores. Also, examination of 202 and 230 soil samples taken under cultivated and non–dune uncultivated plants, respectively, did not reveal this species (Błaszkowski, 1993a; Błaszkowski, unpubl.). Thus, *S. persica* is a rarely occurring arbuscular fungus in Poland. In contrast, according to Bergen and Koske (1984), Friese and Koske (1991), Gemma and Koske (1989), Gemma *et al.* (1989) and Koske (1987), this fungal species belongs to the most frequent inhabitants of maritime sand dunes of the USA. The plant species associated in the field with spores of *S. persica* were *A. arenaria* and *P. spurius*. The spore densities of *S. persica* among roots of *A. arenaria* and *P. spurius* were 3 and 29 in 100 g dry soil, respectively, and are comparable with those presented in the literature (Bergen and Koske, 1984; Friese and Koske, 1991; Gemma *et al.*, 1989; Koske, 1987). The proportions of spores of this species in the spore populations of all arbuscular fungi recovered under *A. arenaria* and *P. spurius* were 12.0% and 17.7%, respectively. The species of arbuscular fungi accompanying *S. persica* among roots of *A. arenaria* were *Glomus constrictum* Trappe, *G. corymbiforme* Błaszk., and *S. dipurpurescens* Morton & Koske. The fungi occurring together with *S. persica* in the soil collected under *P. spurius* were an undescribed *Entrophospora* sp., *G. corymbiforme*, and an undescribed *Glomus* sp.

The soil chemical properties of the dunes adjacent to Świnoujście are: pH, 3.8–6.7; NO_3 (mg L^{-1}), 20–72; P, 5–12; K, 2–

26; Mg, 10–41; Na, 4–23; Cl, 15–25; KCl, 0.1–0.6; organic C (%), 0.1–1.1 (Błaszkowski, 1995).

MYCORRHIZAL ASSOCIATIONS. *Scutellospora persica* was associated in the field with vesicular–arbuscular mycorrhizae of *A. arenaria* and *P. spurius*. This fungus formed arbuscular mycorrhizae in single–species pot cultures with *P. lanceolata* and *S. vulgare*.

The distinctive properties of *S. persica* are its large and dark–colored spores ornamented with small warts. The warts are present in all spores coming from pot cultures. However, the outermost layer of spores collected from the field frequently is partly smooth. The warts of these specimens usually are poorly visible. Uneven distribution of warts or their lack on a part of the surface of field–collected spores probably results from the degradative effects of soil parasites, as Morton (1995) suggested.

The two–layered structure of *S. persica* spores is well visible in both specimens collected from the field and pot cultures. However, the outer layer forming the surface of spores propagated in pot cultures frequently detaches from the laminated layer 2 of spores stored in a drop of lactic acid for a few days and, thereby, is easy to recognize and characterize. Slight swelling of the outer spore wall layer in lactic acid also occurs in *S. armeniaca* Błaszk. (Błaszkowski, pers. observ.).

Two thin, hyaline layers constituting the inner wall of *S. persica* spores usually are tightly adherent to each other and rarely separate in even vigorously crushed spores. Hence, they frequently are visible as a 1–layered structure, especially in spores coming from the field. Disclosure of two layers in the inner wall is relatively easy when spores slightly crushed with a needle are first stored in a drop of lactic acid for a few days and then mounted in PVLG and crushed again.

The germination shields of *S. persica* spores found in Poland are highly ornamented with straight, Y–shaped, and convoluted ridges. Hence, these properties resemble those of the germination shield originally characterized by Koske and Walker (1985), but differ from those given by Morton (1995). The germination shield of *S. persica* spores investigated by Morton (1995) was ornamented with densely distributed papillate ingrowths and outgrowths. This suggests that the properties of a germination shield are variable and, therefore, are a week criterion in delimitation of species of the genus *Scutellospora*.

Other species of the genus *Scutellospora* forming spores ornamented with warts are *S. coralloidea* (Trappe, Gerd. & Ho) Walker & Koske, *S. gregaria* (Schenck & Nicol.) Walker & Sanders, *S. heterogama* (Nicol. & Gerd.) Walker & Sanders, and *S. verrucosa* (Koske & Walker) Walker & Sanders. The shape and size of warts are the main properties separating *S. persica* (rounded warts; 0.5 µm wide x 0.5 µm high) from *S. coralloidea* (flattened warts; 2–12 µm wide x 1–2 µm high) (Morton, 1995; Błaszkowski, pers. observ.) and *S. gregaria* (rounded warts; 2–7 µm wide x 1–2 µm high) (Morton, 1995; Błaszkowski, pers. observ.). *Scutellospora heterogama* produces smaller spores (100–280 µm diam vs. 270–435 µm diam in *S. persica*) with larger warts (1–5 µm high vs. 0.5 µm high in *S. persica*) and with two 2–layered inner walls (vs. one 2–layered wall in *S. persica*) (Franke and Morton, 1994). Spores of *S. verrucosa* are lighter–colored [pale–straw to pale yellow–brown vs. pale to dark copper (Morton, 1995) or greyish orange to tomato red in *S. persica* (Błaszkowski, pers. observ.)] and have larger warts (0.5–1 µm wide x 0.5–1 µm high vs. 0.5 µm wide x 0.5 µm high in *S. persica*) (Morton, 1995; Błaszkowski, pers. observ.).

There are only eight reports of the occurrence of *S. persica* in the world, of which six come from the USA, one is from Brazil, and one informs of the presence of this fungus in Europe. Except for the Brazilian record, the others regard *S. persica* found in dune soils. This fungus was originally described based on spores recovered under *Solidago sempervirens* colonizing a barrier dune in New Jersey (Koske and Walker, 1985), although among the collections examined also were those from Maryland, Massachusetts, Rhode Island, and Virginia. A common occurrence of *S. persica* in dunes of Massachusetts, Rhode Island, and those extending from New Jersey to Virginia was also mentioned by Bergen and Koske (1984), Koske (1987), Gemma and Koske (1989), Gemma *et al.* (1989), and Friese and Koske

(1991). Trufem *et al.* (1990) found *S. persica* spores associated with different ornamental plants in the Säo Paulo Botanic Garden. Puppi and Riess (1987) discovered this fungus in soils of a sand dune system on the tirrenian coast of central Italy.

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CONTRIBUTION TO THE KNOWLEDGE OF NORTH AMERICAN SUILLUS SPECIES (BASIDIOMYCOTINA, BOLETALES)

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Abstract. On the basis of numerous records the identity of *Suillus umbonatus* Dick and Snell and *S. flavidus* (Fr.:Fr.) J.S.Presl is demonstrated. *Suillus subalpinus* Mos. is described as new species. A possible record of *Suillus brunnescens* A.H. Smith & Thiers is reported from Europe.

Key words: *Suillus, Pinus,* North America, Europe.

During studies on fungi in Wyoming some collections of *Pinus*-associated species of genus *Suillus* made comparisons with European taxa necessary. The results will be presented here.

Material and methods.

When harvested, each collection was wrapped in aluminum foil. The collections were transported in cool boxes and kept in the laboratory refrigerator until color photographs and detailed written field notes were taken the same or latest the next day in the University of Wyoming National Park Service Research Center at Moran. The detailed microscopic study was carried out in Innsbruck with an Olympus BHS2 microscope, a Sony SSC-C350P color video camera and a Sony Kx14CP1 monitor. Basidiospore measurements for statistical purposes were made from video prints using a Sony UP 9120 video printer. Dried material was mounted in 3% KOH solution for microscopic study or in ammonia for study of gelatinized structures.

Abbreviations in spore measurements: S= standard deviation (n=31), Q= quotient of spore length through spore width, V= spore volume. For basidia 5-6 were measured in each collection.

Color Codes used: R= Ridgway (1912), Caill = Cailleux (1981).
Specimens are deposited in the Herbarium of the Institut of Botany of the University of Innsbruck (IB) .

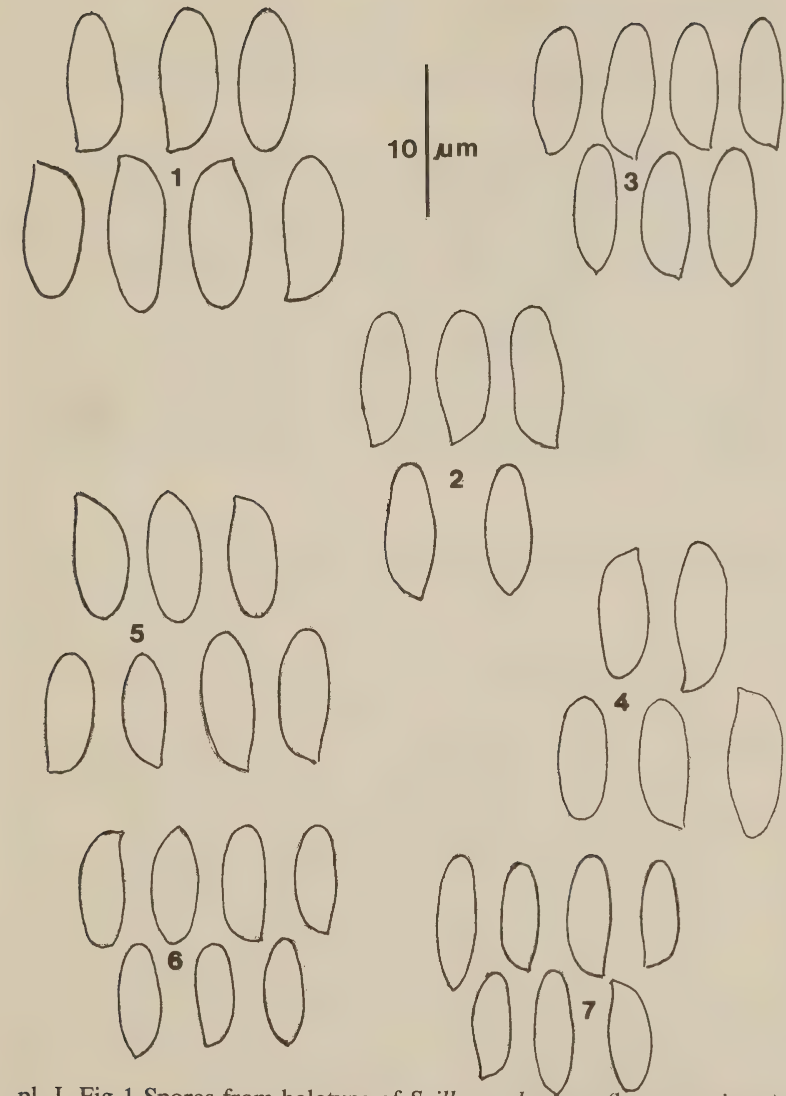
1. Are *Suillus umbonatus* Dick & Snell and *S. flavidus* (Fr.) J. S. Pres. 1846 conspecific ?

Figs. 1, 2, 3 and 4

Several records of *Suillus umbonatus* in Wyoming suggested immediately an identity with *S. flavidus*. The latter species I know from records from different localities in Europe, both from Tyrol and Scandinavia. In September 1994 the species was particularely frequent in the area of Femsjö. This area can be regarded as the type area. Fries described the fungus in Observationes Mycologici I (1815). He collected most of the material for this book in the Femsjö area. The name is sanctioned in Systema I (1821) and Fries listed it in Stirpium Agri Femsjonensis on p.58. The pages 1-58 were printed 1825. In the United states I collected the species in several localities in Wyoming, Oregon and California. Therefore I could study this taxon in the full range of variability. Only the collection from California had a slightly darker honey-brown glutinous universal veil. But this slight difference in pigmentation is only quantitative and does not permit the distinctinction of a separate variety. The type of *S. umbonatus* came from Trial Lake Campground, Uintah Mountains, Utah, coll. K. H. McKnight, 29 Aug. 1954 (Bolete Herbarium W. H. Snell 2281), Beltsville 737735.

Microscopic characters of the holotype of *Suillus umbonatus*:

I studied three basidiomata of the collection. The spore measurements are: **a**: 8.2-12.9x3.5-4.4 μm, mean 9.8(S=0.9)x4.0(S=0.23) μm, Q=2.1-3.1, mean 2.5, V=58-115 μm^3, mean 82 μm^3; **b**: 8.8-10.9x3.5-4.4 μm mean 9.9 (S=056x3.9 (S=0.2)μm, Q= 2.2-2.8, mean 2.5, V=58-108 μm^3, mean 82 μm^3; **c**: 7.9-10.0x3.2-3.8 μm, mean 9(S=0.5)x3.5(S=0.15) μm, Q=2.3-2.8, mean 2.5, V=44-74 μm^3, mean 59 μm^3, smooth, slender cylindric-subfusiform (boletoid). Basidia 28-31x6-7 μm, 4-spored, clavate-cylindric, hymenophoral trama of 4-5.5(-7) μm wide, more or less of colorless hyphae. Cheilocystidia 70-100x6-9(-10) μm, irregularely knobby, with more or less dark brown walls. Pleurocystidia similar but mostly smaller, 25-50x4-6 μm. Pileipellis an ixocutis of 3-4 μm wide hyphae with granulose surface, repent to irregular, colorless under the microscope, in mass pale yellowish, in deeper layers with yellow-brown walls and also interhyphal pigment accumulations. Gelatinous veil of 3-4.5-8 μm wide hyphae with strongly granulose surface and very pale



pl. I. Fig.1 Spores from holotype of *Suillus umbonatus* (large specimen).- Fig. 2. Spores from holotype of *S. umbonatus* (smaller specimen).- 3. Spores of *S. flavidus* coll. 94/246, Stora Mosse, Femsjö.- 4. Spores of *S. flavidus* coll. 94/185b, Weasel Creek, Yellowstone National Park.- 5. Spores of *S. subalpinus* 91/444.- 6. Spores of *S. subalpinus* 89/293.- 7. Spores of *S. brunnescens* 94/395 (Bedonia) yellowish brown pigmentation.

Microscopic characters of swedish collections of *Suillus flavidus* from Femsjö.

Spores 7.6-10x3.2-4.1 μm, mean 8.6(S=0.5)x3.7 (S=0.14)μm , Q=(1.9)2.3-2.8, mean 2.5(S=0.15), V=53-88 μm^3, mean 62(S=7) μm^3, cylindric fusoid, colorless or with olivaceous content, basidia 27-33x6-7-(8) mm, clavate, 4-spored. Hyphae of hymenophoral trama 2.5-4.5 μm, richly branched, without clamp connections. Hymenophoral cystidia in bunches or large fascicles, filiform, slender clavate or lanceolate, 35-90(-100)x4.5-7, at first hyaline or with granular contents, later with brown contents but not encrusted. Pileipellis on surface with 2.5-5 μm wide hyphae, colorless to pale yellowish often with granular contents and slight encrustation. Hyphae of universal veil 2.5-8.5-(10) μm, with strong colorless to olive brownish encrustation, some with pale olivaceous brown contents. Pileus trama hyphae 5-8 μm, very pale ochraceous, p.p. slightly encrusted.

Table 1. Comparison of the main characters of American and Swedish collections of *Suillus umbonatus* Dick & Snell and *Suillus flavidus* (Fr.:Fr.) Presl

	Description of collection from Wyoming	Description of collection from Sweden
Pileus	3.5-9 cm diam., conico-convex to applanate and mostly with umbo, glutinous, gluten nearly colorless to yellowish or even yellow-brown to honey colored, grayish yellowish, dingy yellowish, often with olivaceous tinge, R (Isabella Color) , Olive Ocher, Honey Yellow, Chamois, Antimony Yellow or mixtures, often mixed with brown, always marbled and spotted or variegated.	2-8 cm diam, mostly 3-5.5 cm, obtusely conic, later applanate but mostly with umbo, glutinous, gluten colorless to pale brownish or honey-colored, in young specimens yellow-brown (Caill 65N), sometimes nearly 57N), later much paler and often with slight olivaceous hue (Caill 77L), slightly innately fibrillose or marbled, brownish where bruised.
Hymenium	tubular, tubes short, 3-5 mm, pores yellow, Amber Yellow (R), rather wide with age, 1.5 mm and more, irregular, decurrent on stipe	tubes 3-5 mm long, unequal in height, yellow, pores yellow, Amber Yellow (R) when fresh, irregular, rather wide, about 1.5 mm or more, decurrent on stipe

Stipe	3-6x0.6-1cm, equal or slightly clavate, but mostly base tapering, pale yellow on apex, below the gelatinous, yellow- to honey-brown ring pale yellowish, toward the base whitish, with age turning dingy brownish, glandular dots at first concolorous, with age brown, but in general inconspicuous.	3-7(-8)x0.3-1 cm, equal or base tapering, apex pale yellow, with gelatinous, yellow-brown to honey-brown ring, apex smooth to slightly punctate (glandular), below ring dingy yellow, with age staining brownish, slightly rugose or not, base whitish. Glandular dots concolorous, with age staining brown, but not conspicuous.
Context	yellowish, in stipe with an olivaceous tinge. Not staining blue.	Light Buff in pileus, dingy yellowish in stipe, somewhat marbled. Not staining blue.
Spore print	Ochraceous Tawny; when dry Sayal Brown (R)	Ochraceous Tawny; when dry Sayal Brown (R)
Microscopic characters	Spores 7-10x3.2-4.7 μm, basidia 25-29x6-6.5 μm, 4-spored, cheilo- and pleurocystidia 50-60-(100)x6-10 μm, clavate, club-shaped, often knobby, when young nearly colorless, but soon dark brown with brown contents, often slightly encrusted. Pileipellis an ixocutis or gelatinized, 5-7 mm wide repent hyphae, very pale ocher olivaceous, deeper layer not gelatinized, hyphae 5.5-8.5 μm, stronger pigmented, partly encrusted with platelets. Hyphae of gelatinous annulus 2.5-5,5 μm, pale olivaceous ocher, slightly granulose encrusted	Spores 7.6-10x3.2-4.1 μm, colorless or with olivaceous content, basidia 27-33x6-7(-8) μm, 4-spored, cheilo- and pleurocystidia 35-90(-100)x4.5-7 μm, at first colorless or with granulose content, later with brown content. Pileipellis surface hyphae 2.5-5 μm wide, colorless to pale yellowish, slightly encrusted, in deeper layer hyphae 5-8 μm, olivaceous ocher, encrusted. Hyphae of annulus 2.5-8,5 (-10) μm, colorless or brownish olive encrusted, some with pale olivaceous brown contents.
Habitat	under two-needle pines (*Pinus contorta)* (var. *murrayana* in California) in swampy sites, often among *Sphagnum*	under two-needle pines (*Pinus sylvestris*) (in the Alps also with *P. mugo*) in swampy sites, often among *Sphagnum*.

Collections examined:

U. S.A.: Utah: Trial Lake Camp Ground, Uintah Mts., coll. K.H.McKnight, 29 Aug. 1954

(Bolete Herbarium W.H.Snell 2281), Beltsville 737735 (Holotype);-. **Wyoming**: IB 91/228, east of pond north from Arizona Lake, Teton National Forest, numerous. 11 August 1991, leg. M. Moser; - IB 91/421 Falls River near Waterfall, Yellowstone National Park, 4 Sept 1991 leg. M. Moser; - IB 94/84, swampy area along Lewis River Channel to Shoshone Lake, Yellowstone National Park, 27 July 1994, leg. M. Moser; - IB 94/185 and 94/185b, Weasel Creek near Sand Point, Yellowstone National Park, 24 Aug 1994, leg. M. Moser; - **Oregon:** IB 95/440 Sand Lake Area, Tillamook Co., 2 Nov. 1995, leg. M.Moser; - **California:** 91/672 Mendocino, 1.5 miles on Rd. 408 east of the city, *Pinus contorta* var. *murrayana* Engelm. 5 Dec. 1991, leg. M. Moser.

Europe: Sweden: 74/179, Femsjö, Kyrke Mosse 22 Aug. 1974, leg. M. Moser;- 79/279 moor at Erstaviken, Femsjö, 12 Aug. 1979, leg. M. Moser; - 80/382, high moor west of Stensjö, Femsjö, 21 Sept 1980, leg. M. Moser; - 84/60, Lilla Hjortsjö, Femsjö, 7 Aug. 1984 leg. M. Moser;- 94/244, Stora Mosse, Femsjö, Smoland, Sweden, between road and Källenäset, 13 Sept 1994, leg. M. Moser; - 94/245, 94/246, 94/247, 94/248, all in this locality and on same date but different sites.

Norway: 95/86, Luleslätta, Skibotndalen, Troms, *Pinus sylvestris*, leg. M. Moser, 09-Aug. 1995.

Austria : In North-Tyrol observed from 3 localities but no collections preserved.

Italy: 96/90 "Biotop" of Antholz near Rasen Antholzer valley, South Tyrol, 7 Sept 1996, leg. M. Moser.

Comments: Surprisingly in North America for some time this taxon was confused with *S. sibiricus* (A. H. Smith 1949). And what is more surprising, neither Dick and Snell nor any other author compared it with *S. flavidus* although in the European literature we find numerous good to excellent colored reproductions (e.g. Kallenbach 1939-42, pl. 50). At first I thought that the American collections have slightly larger spores, but when compared the measurements of different collections we see the same range of variation both in Europe and America. Measurements from three basidiomata from the holotype of *S. umbonatus* Dick & Snell show the same range of variability (see Table 1).
Summarizing I can conclude, that the two taxa are conspecific and that the correct name is *Suillus flavidus* (Fr.) S. J. Presl (1846) and that *S. umbonatus* Dick & Snell has to be regarded as a synonym.

Table 2. Comparison of spore data from different collections of *Suillus flavidus* resp.*S. umbonatus*. (S = Sweden, N = Norway, I = Italy)

Collection	mean (N=31)	max	min	Q	V
95/245 Femsjö S	8.6x3.6	10x4	7.6x3.4	2.4	57
74/179 Femsjö S	8.7x3.5	10x4.1	7.6x3.2	2.5	58

95/86 Luleslätta N	8.7x3.7	10x4	7.8x3.5	2.3	62
80/382 Femsjö S	9.1x3.7	10x4	8.2.6x3.4	2.5	65
94/247, Femsjö, Stora Mosse, S 2 fruitbodies	9.0x3.6 9.0x3.7	10.0x4.1 9.7x4.1	8.2x3.2 8.5x3.4	2.5 2.5	62 63
96/90 Antholzer Valley, South-Tyrol,I	8.9x3.7	10.1x4.3	7.4x3.4	2.4	65
holotype *S.umbonatus* (a)	9.8x4	12.9x4.4	8.2x3.5	2.5	82
holotype *S.umbonatus* (b)	9.9x4	10.9x4.0	8.8x3.5	2.5	82
holotype *S.umbonatus* (c)	9.0x3.5	10x3.8	7.9x3.2	2.5	59
95/440 Sandlake area Oregon	8.7x4	10x4.3	7.1x3.2	2.1	75
94/84 Lewis River Channel, Wyo	8x3.5	9.4x3.9	7.1x3.1	2.3	52
94/185a Weasel Creek. Wyo	8.7x3.7	10x4.7	7.3x3.2	2.4	64
91/672 Mendocina CA	9.4x3.7	10.6x4.1	8.2x2.9	2.5	67

2. A new spcies from the Greater Yellowstone area: *Suillus subalpinus* Mos. sp.nov.

Figs. 5, 6, 8 and 9.

Pileo 3-7.5 cm lato, convexo-pulvinato, margine involuto, aetate applanato usque subdepresso, valde glutinoso, margine albido, discum verso fusco, porphyraceo vel vinaceo-brunneo, saepe maculato vel variegato, poris primo albidis, aetate flavescentibus. Stipite 2-5.5 cm longo, 10-25(-40) mm crasso, aequali vel basi incrassato sive attenuato, albido, glandulis albidis dein rubeolis, aetate brunnescentibus adornato. Carne albida, in aetate flavescente, interdum primo in basi stipitis leniter coerulescente. Absque velo.

Sporis 6.5-7.7(-9.2)x2.5-2.9(-3.8) μm, cylindrico-subfusoideis, levibus, pallide olivaceis, basidiis 23-32x6.5-8 μm, tetrasporigeris, cystidiis

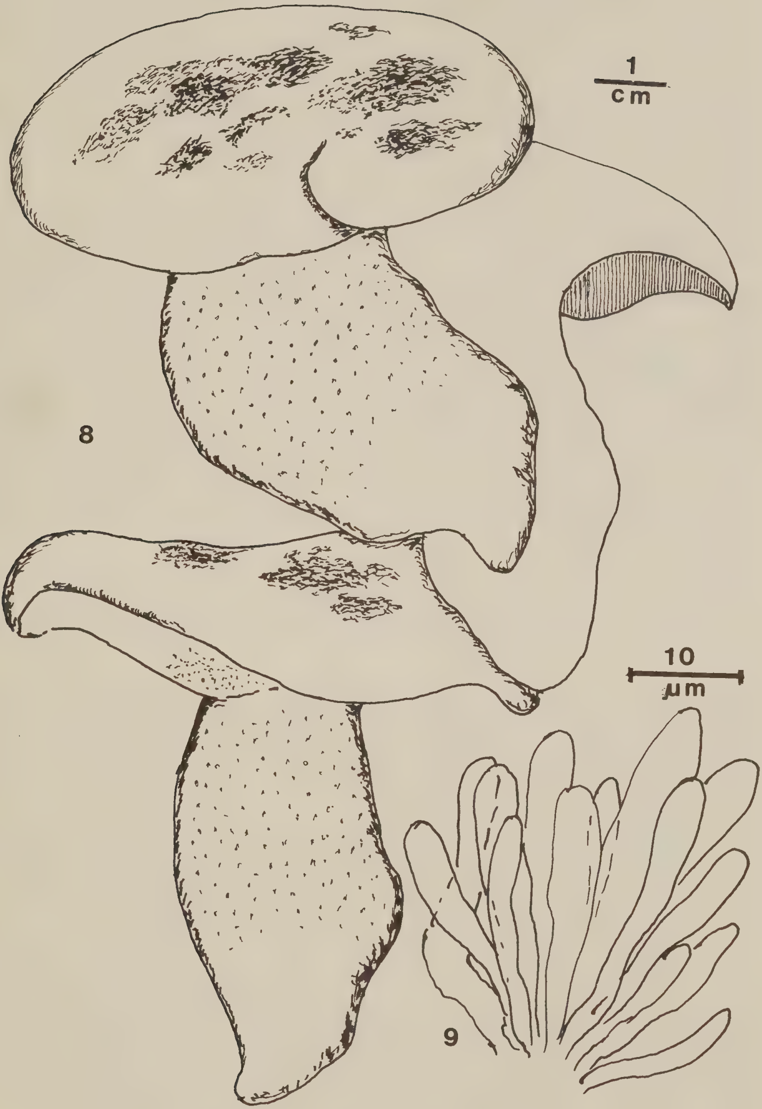
clavatis usque subcapitatis, 40-50(-80)x6-12 µm.
Habitatio in silvis coniferis subalpinis (*Pinus albicaulis, P. flexilis)*. Holotypus 89/293, supra lacum dicto "Amphitheater", Grand Teton National Park, leg. M. Moser, 20-Aug- 1989, in herb. IB conservatus est.

Pileus 3 to 7.5 cm diam., convex, margin involute, disc with age applanate or even slightly depressed, very glutinous when young, then glutinous to viscid, margin white, toward the center gray-brown to porphyraceous or vinaceous brown, or often on whitish ground with gray-brown areas and spots , Caill 55M to 55N, R approximately Fawn Color to Mikado Brown, mottled and variegated, the white areas in age becoming more beige or ivory white. Tubes and pores at first white, whitish to ivory, later slowly turning more or less yellow, Cream Buff, Colonial Buff (R), pores at first very fine, with age wider, 2-3 per mm, tubes rather short, 3-5 mm long. Stipe 2-5.5 cm long, 10-25 mm, base occasionally up to 40 mm thick, equal or base tapering or enlarged but the very base pointed, white, over the whole length with well developed at first white, later reddish glandular dots which turn brownish to porphyraceous with age. Apex with age becoming slightly yellowish. Without any trace of veil. Context white, in young specimens in base sometimes slightly bluish but not really changing color, with age very faintly yellowish. Without distinctive odor, taste mild.
Spore print olive to brownish olive.
Microscopic characters: Spores small, slender cylindric subfusoid, 6.5-7.7(-9.2)x2.5-2.9 (-3.8) µm, mean 7.1(S=0.34)x2.7 (S=0.13) µm, Q=2.4-3.0, mean 2.6 (S=0.11), V= 23-35 μm^3, mean 28 (S=3.8) μm^3, (in coll. 91/444: 6.5-10.0x2.2-3.5 µm, mean 8.3(S=0.8)x2.8(S=0.26) µm, Q= 2.4-3.6, mean 3.0, V=18.5-65 μm^3 , mean 34.7 μm^3), smooth, thin walled, pale olivaceous under microscope. Basidia 23-32x6.5-8 µm, 4-spored, clavate. Hymenial cystidia clavate, sometimes slightly capitate, 40-50-(80)x6-12 µm , base 2-3 µm, single or in large fascicles or cushions, colorless or with brown contents, walls encrusted and often pigment accumulations around the base, cheilocystidia clavate, 20-90x5-9 µm, with brown contents, often in large clusters. Pileipellis an ixocutis, hyphae on surface 2-2.5 µm, colorless, granulose encrusted, irregular to subrepent, in deeper layer up to 7 µm wide and walls pale brown, encrusted and more regularely arranged.

Habitat: growing under five-needle pines (*Pinus albicaulis* Engelm., *P. flexilis* James) in subalpine forests up to timber line.

Collections examined: IB 89/293, below Amphitheater Lake, about 3000 m, Grand Teton National Park, 20 Aug 1989, leg. M. Moser. (Holotype) - IB 91/444, below Surprise Lake, 2900 m, Teton National Park, 10 Sept 1991, leg. M. Moser.

Comments: This species resembles *S. brunnescens* Smith & Thiers



pl. II. Fig. 8. Fruitbodies of *Suillus subalpinus* 89/293.- 9. Hymenial cystidia of *S. subalpinus* 89/293.

and older specimens could be confused with it, but lacks a veil. In 1987 a fungus was observed on Mt. Washburn, Yellowstone National Park, which macroscopically resembled very much the above described fungus, but was determined as *S. brunnescens*. The bulk of this collection was given to H. Thiers, but could not be found now in San Francisco. One specimen of the collection was kept in the herbarium of the University of Washington, JFA 9411. On this specimen no trace of a veil could be found. However, this is a mature specimen and veil remains may not be longer visible. The spores measure 7.1-8.5x2.8-3.5, mean 7.7(S=0.4)x3.1 (S=0.16), Q=2.5, V= 37.5 μm^3, i.e. in the range of the above described taxon. But one specimen is not sufficient to arrive at a conclusion. *S. albidipes (Peck) Sing.* can also have white to vinaceous brown colors, has similar spores and may also occur with 5-needle pines. However, the glandular dots of the stipe are lacking in young stages and only slightly developed with age in lower parts. *S. pallidiceps* Smith & Thiers changes color from white to yellowish or cinnamon buff, has no glandular stipe and grows with 2-needle pines (*Pinus contorta)* (Smith and Thiers 1964). *S. subalpinus* reminds me of *S. bellinii* (Inzenga) Watl., which is associated with Mediterranean 2- and 3-needle pines particularly in maritime habitats, which differs, apart from the habitat, by larger spores, by the appearance of more yellow color admixtures both on pileus, stipe and context.

3. *Suillus brunnescens* A. H. Smith & Thiers 1964 in Europe ?

Fig. 7.

In Bedonia , Prov. Parma, Italy, we observed a *Suillus* species, which we could not identify with any European species. As the locality is in a planted park the species could be introduced. It seems to correspond fairly well to *Suillus brunnescens* Smith & Thiers.

Pileus 3.5-7 cm, convex, margin at first involute to inbent, at first closed by a membranous veil which is whitish on the outside, however, at first covered by some incarnate brownish gluten, after expansion the pileus margin remaining appendiculate, very glutinous (collected after heavy rain), young specimens with white and pale brown areas, later becoming chocolate brown over the middle, paler toward the margin and sometimes even with some incarnate brown cast, but also older specimens always retaining some white spots. Tubes and pores at first white, but soon becoming yellow, pores irregular to polygonal, 2 per mm, tubes 5-6 mm long. Stipe 2.5-4 cm long, 15-20 mm thick, yellowish to yellow, without veil remains, with brownish glandular dots. Basal mycelium white. Context pale yellowish, in center of stipe white.

Microscopic characters: spores cylindric, boletoid, 6.5-8.8x2.3-3 μm, mean 7.8(S=0.6)x2.4(S=0.14) μm, Q= 2.7-3.6, mean 3.2 (S=0.26), Vol. 18.7-37.3, mean 24.3 (S=4) μm^3. Basidia 19-23x5-6 μm, 4-spored; cystidia clavate to cylindric or nodulose, 25-50x7-13 μm, in KOH partly wine-red or brown.

Habitat: Under *Pinus strobus* and *P. nigra*, probably associated with the former. Coll. 94/395, Park of Seminario Vescovile, Bedonia, Val di Taro, prov. Parma, Italy. 4 Nov. 1994, leg. M. Moser

Comments: As the collecting site is situated at the margin of a planted park it is probable that this species has been introduced. I was unable to identify it with any known European *Suillus* species. One could think of *S. luteus* fo. *alba* Wasser & Soldatova in Wasser (1974) which has similar spore dimensions but is described as completely white and with a strongly developed annulus. *S. hololeucus* Pantidou (1964) has a white pileus becoming green to yellow-brown spots, a membranous annulus and somewhat larger spores (8-11x3.5-4.5 μm) and seems to be associated with larch. On the other hand it has many characters in common with the American taxon *Suillus brunnescens* A. H. Smith & H. D. Thiers. These are the colors, size, and the veil which does not form an annulus but remains appendiculate on the pileus margin. Also the spore shape and size is the same. Spore measurements for *S. brunnescens* are given with 6.6-8.8x2.8-3.3 μm. All records of *S. brunnescens* are reported as associated with sugar pine (*Pinus lambertiana* Dougl.) (Smith & Thiers 1964, Halling 1977), which is also a five-needle pine.
The locality in Bedonia will be observed in the future.

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RHODOTUS PALMATUS (BASIDIOMYCETES, AGARICALES, TRICHOLOMATACEAE) IN ILLINOIS

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ABSTRACT

Although widespread, *Rhodotus palmatus* is considered by some to be rare in the United States. Previous reports for Illinois noted its occurrence in only two northern counties--Cook and Henry--and two adjacent central Illinois counties--Champaign and McLean. However, recent collections made by us and a survey of additional herbarium material from other parts of the state support a broader distribution pattern. New records include specimens from Coles, Hancock, Jackson, Jo Daviess, Knox, Moultrie, Shelby, Vermilion, and Warren Counties. Within Illinois, *Rhodotus palmatus* is not found with frequency during any one collecting season. Morphological and most anatomical features of Illinois material agree with previous descriptions. Contrary to Singer's circumscription, cheilocystidia were often abundant. The degree of gelatinization in the pileus trama appeared related to cell depth within the tissue; elements further removed from the surface were less gelatinized. This variation in gelatinization was less evident in the lamellar trama. The documented fruiting period in Illinois extends from May through October, with no records for July.

Circumboreal in distribution (Redhead, 1989), *Rhodotus palmatus* (Bull.: Fr.) R. Maíre is considered by some to be rare in the United States (Miller, 1977; Smith, Smith, and Weber, 1979). Neither Moffatt (1909), who authored a preliminary study of fungi in the Chicago area, nor Graham

(1944), who collected extensively in the Chicago and adjacent Great Lakes region, indicated the presence of this species. Previous reports noted the occurrence of *R. palmatus* in Illinois in only two northern counties--Cook and Henry (Redhead, 1989)--and two adjacent central Illinois counties--Champaign (McDougall, 1922) and McLean (Cooke, 1969). However, recent collections made by us and a survey of additional herbarium material from other parts of the state indicated that *R. palmatus* was much more widely distributed. Therefore, we initiated this project to more completely document the occurrence of *Rhodotus palmatus* in Illinois.

Standard techniques for the collection, preservation, and description of agarics (Smith, 1949) have been followed. Color terms in quotation marks were taken from Ridgway (1912). Characters observed most readily with a 10 X hand lens are followed by the parenthetical statement "with lens." Micromorphological features were studied and measurements were taken from materials revived in 95% ethanol then water, blotted, sectioned, and mounted in 3% KOH with or without phloxine stain. Specimens were deposited in the herbaria at Southern Illinois University at Carbondale (SIU) and Eastern Illinois University (EIU). In addition to collections at SIU and EIU, specimens in the herbaria at the Field Museum of Natural History, Chicago (F), the University of Michigan (MICH), and Western Illinois University (MWI) were examined and annotated. Herbarium abbreviations follow Holmgren *et al* (1990).

Rhodotus palmatus (Bull.: Fr.) R. Maire. Bull. Mycol. Soc. Fr. 40: 308. 1925. Figs. 1-5

Pileus 1.5-9 cm broad; convex to broadly convex or nearly plane; margin decurved, becoming nearly plane, striate at the extreme edge; surface dry to moist, covered with short, very fine white hairs (with lens) which sometimes form a loose-appearing thin layer of cottony fibrils, decorated with a network of raised, round-edged, reticulate ridges; ridges appearing moist (with lens), glabrous; ground color "light pinkish cinnamon" to "pinkish cinnamon," ridges concolorous to somewhat darker, near "cinnamon," extreme margin "orange-cinnamon" and sometimes appearing hygrophanous. **Flesh** of pileus up to 8 mm thick, solid; pale pink to near "shell pink," but intermixed with nearly white areas, not staining. Taste bitter. Odor not distinctive to somewhat pungent-aromatic. **Lamellae** adnexed, close, up to 11 mm broad, not forked, "pinkish cinnamon" to "vinaceous-cinnamon," not staining; margins even, not fimbriate (with lens), concolorous with lamellae, becoming dull brown; lamellulae in 2 to 4 tiers, concolorous. **Stipe** 1.5-3 cm long, 4-10 mm broad at the apex; eccentric to nearly central in attachment, equal; surface dry, covered with a very thin layer of short upright hairs that are easily rubbed off; ground color "dark pinkish buff" to "cinnamon-buff" above, "saccardo's umber" to "sayal brown" or "tawny olive" below (darker basal colors most evident in

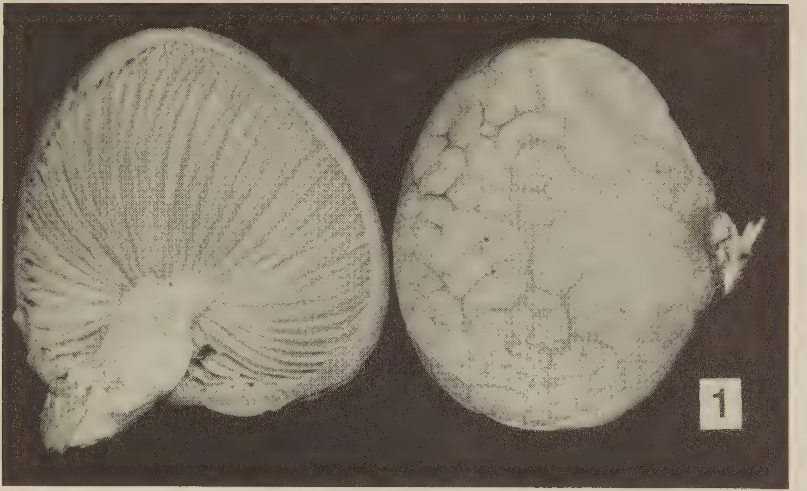
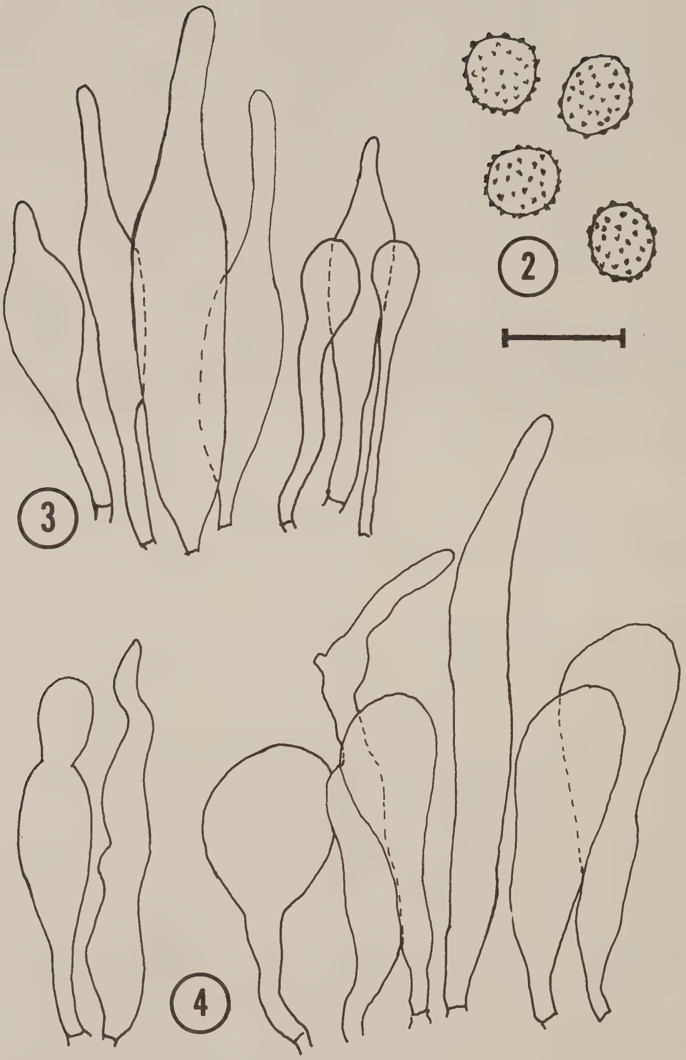


Fig. 1. *Rhodotus palmatus*. Sundberg 2390. Approx. X 1.

older specimens); flesh solid, concolorous with the pileus flesh to "cartridge buff" with a slight olive cast above, becoming somewhat darker below, "tawny olive" to "saccardo's umber" near the surface at the base.

Spore print "pinkish buff" to "light pinkish cinnamon," "cinnamon" where the lamellae contacted the paper; paler and nearly "pale pinkish buff" where thin.

Basidiospores 6-8.7 x 6-7.4 µm; subglobose to ovoid; surface with numerous very fine warts; wall thin; hyaline in KOH, inamyloid. **Basidia** 33.6-43.2 x 5.6-8 µm; clavate, 4-spored; contents granulose with numerous large oil droplets; hyaline in KOH. **Pleurocystidia** lacking. **Cheilocystidia** abundant; 27.2-48 x 4.8-8 µm; fusoid-ventricose to ventricose-rostrate to lageniform, more rarely sphaeropedunculate with extremely long narrow bases; walls smooth, thin; contents granulose to amorphous; hyaline in KOH, pale yellow in Melzer's reagent. **Lamellar trama** divergent but becoming less so in age, divergent nature not evident in all sections; hyphae 3.2-4.8 µm broad; embedded and separated from one another within a thick gelatinous layer, especially toward the lamellar edges and internal to the subhymenium; contents amorphous to granulose (latter more evident toward the hymenium), hyaline in KOH. **Pileus trama** just beneath the pileipellis gelatinous , becoming less so toward the undersurface of the pileus, some areas lacking gelatinous material altogether, especially near the lamellae; embedded hyphae 3.2-4.8 µm broad, some with undulate walls; non-gelatinous cells 4.8-14 µm broad; all



Figs. 2- 4. Anatomical features of *Rhodotus palmatus*. Scale line = 10µm. 2. Basidiospores. 3. Cheilocystidia. 4. Pileipellis elements.

hyaline in KOH. **Pileipellis** hymeniform, appearing cystoderm-like in surface or oblique view, arising from a thin and tightly interwoven subpellis; composed of more or less saccate-clavate to clavate or sphaeropedunculate cells intermixed with beaked to nearly hyphal-like elements that often extend well above the rest of the hymeniform layer, some areas almost totally devoid of protruding elements; hymeniform elements 28.8-48 x 9.6-25.6 µm, some sphaeropedunculate with long and narrow pedicels, others clavate to saccate-clavate or, more rarely, broadly ventricose; protruding elements 52.8-83.2 x 6.4-20.8 µm, some clavate with one or more subapical constrictions, others irregularly cylindrical, strangulated, some nearly hypha-like; walls of all elements thin to somewhat thickened, smooth; no visible cytoplasmic contents; all elements pale brown in mass, hyaline in KOH. **Clamp connections** present.

HABIT AND HABITAT: Scattered to gregarious on logs of deciduous trees.

FRUITING PERIOD: May to October, not recorded for July and most often collected in August and September. Not frequently encountered in any one year.

COLLECTIONS STUDIED: **Coles Co.**: Grunder 75, Methven 5607 (both EIU), Schanzle s.n. (SIU); **Hancock Co.**: Deener 28 (MWI 341), Gessner 882, 907, 922, Ierulli s.n. (MWI 1142), Johnson 21 (MWI 745) (all MWI); **Henry Co.**: Harper and Harper 3702 (F 1285568); **Jackson Co.**: Sundberg 2930 and 94-VI-25-A2, Pursell s.n., and Lipe 3 (all SIU); **Jo Daviess Co.**: Methven 6725 (EIU); **Knox Co.**: Wujek 339 (SIU); **Moultrie Co.**: Hilchen s.n. (EIU); **Shelby Co.**: Schutte s.n. (F 1104678); **Vermilion Co.**: Petersen 117 (EIU); **Warren Co.**: Wujek 185, 325 (both SIU).

DISCUSSION: In contrast to Singer (1992) and in agreement with Pouchet (1932) and Pearson (1948), we noted the presence of often abundant cheilocystidia. Perhaps the fact that they are difficult to demonstrate (Pearson, 1948) accounts for this discrepancy.

There appears to be a reciprocal relationship between depth of elements in the trama and their degree of gelatinization. In both the pileus and lamellar trama, the further removed the tramal tissue is from the surface of the basidiome, the less gelatinization occurs.

Based on our observations, *Rhodotus palmatus* tends to occur on logs in or near low lying areas, such as swamps and creek or stream beds, that are periodically flooded and where the canopy is relatively closed. In some areas, the logs were at least partially submerged sometime during the year while in others the degree of water coverage could not be determined or was not noted. The nature of the canopy agrees with the findings of Miller,

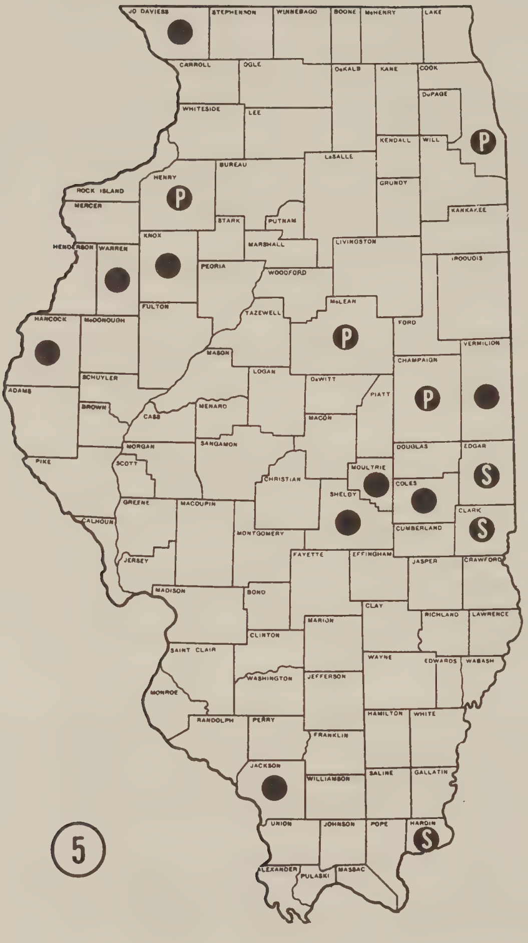


Fig. 5. Currently known distribution of *Rhodotus palmatus* in Illinois by county. Solid circle = new distribution record. P in solid circle = previously known from published record(s). S in solid circle = observed but without voucher collection.

Palmer, and Gillman (1980). High temperatures and concomitant lack of rainfall may, in part, explain the lack of any collections during July.

As illustrated in Fig. 5, new distribution records include specimens from Coles, Hancock, Jackson, Jo Daviess, Knox, Moultrie, Shelby, Vermilion, and Warren Counties. In addition to the collections examined above and information already in the literature, *Rhodotus palmatus* has been found in Edgar and Clark Cos. (Dr. Wesley Whiteside, personal communication; no vouchers) and Hardin Co. (K. Andrew West, personal communication; photographs but no voucher). A distribution map of *Rhodotus palmatus* by Redhead (1989, Fig. 18) illustrates a collection in or near Jo Daviess Co., but we were unable to locate a collection to document this report. Redhead (1989) also attributed to Illinois a Harper and Harper specimen (F) collected from Neebish Island, but, based on data with collections and photographs of other fungi at the Field Museum of Natural History (Chicago), Neebish Island is in Michigan.

As expected, the distribution of forested lands in Illinois (Anonymous, 1980) and that of *Rhodotus palmatus* (Fig. 5) are similar. Much of the central and north-central parts of Illinois are rich agricultural lands, and the absence of *Rhodotus* there is not surprising. Further collecting in other parts of the state should reveal more stations in under-explored areas, especially in the Shawnee National Forest which extends across the southern part of the state, in scattered woods along the Illinois river (which runs northeast to southwest through the middle of the state), and in state parks and other forest preserve areas.

CONCLUSIONS

This work expands the known range of *Rhodotus palmatus* in Illinois to throughout the length of the state. We hypothesize that with additional collecting in currently under-explored areas, *R. palmatus* will be found in most counties with extensive forest stands.

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ANTHRACOIDEACEAE, A NEW FAMILY IN THE USTILAGINALES

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Abstract: The new ustomycete family Anthracoideaceae is described to include taxa having 2-celled, aerial ustidia. Members of the family are *Anthracoidea* and (?) *Planetella*.

Key words: ustomycetes, taxonomy, Anthracoideaceae, Microbotryaceae, Ustilaginaceae.

Tulasne & Tulasne (1847), as a result of germination experiments, separated the smuts into two families: Tilletiaceae and Ustilaginaceae. This division is based on two main types of spore germination, *Tilletia*-type and *Ustilago*-type. Many ustilaginologists, mostly of the first half of our century, used this two-family (or three-family, adding Graphiolaceae) scheme in the regional works (Ciferri, 1938, 1963; Gutner, 1941; Lindtner, 1950; Zundel, 1953; Săvulescu, 1957; Schwarzman, 1960; Mordue & Ainsworth, 1984; Govorova, 1990; Azbukina et al., 1995; etc.). Cunningham (1924) merged the two families in one, the older - Ustilaginaceae. During the last four decades many authors (Fischer, 1953; Lindeberg, 1959; Jørstad, 1963; Kakishima, 1982; Vánky, 1985, 1987, 1994; Scholz & Scholz, 1988; etc.) treated smuts as belonging to only a single family, Ustilaginaceae, because of presence of genera with intermediate type of germination, such as *Schroeteria* (Vánky, 1987) and *Anthracoidea* (Kukkonen, 1963; Vánky, 1987).

Nagler et al. (1989), on the basis of germination and ultrastructure studies, interpreted *Schroeteria*, in seeds of *Veronica* species, as an ascomycete. *Schroeteria*, however, is a natural, clearly circumscribed genus of smuts (Vánky, 1981) on the basis of habit, gross morphology, and ultrastructure (see Moore, 1996a).

Recently Moore (1996a, b) presented a new taxonomic scheme of the ustomycetes. He recognized ten orders in the phylum Ustomycota. The smut fungi were treated as two separate orders: Tilletiales and Ustilaginales. Members of the Tilletiaceae are characterized by the aerial, unicellular ustidium. The parasitic species in the order Ustilaginales was divided between the Ustilaginaceae for species occuring on monocots and the Microbotryaceae for species occuring on dicots. The ustomycetes of Ustilaginaceae germinate like the *Ustilago*-type and these of Microbotryaceae like the *Microbotryum*-type. The ustospores of both families germinate into prostrate, 3-4 celled ustidia. Fragmentation of the ustidium and some other modifications of the basic pattern of ustidium often occur, including cases of 2-celled ustidium [*Moesziomyces bullatus* (Schröter) Vánky - Ingold, 1988, 1989b; *Ustilago commelinae* (Komarov) Zundel - Ingold, 1989b; *Ustacystis waldsteiniae* (Peck) Zundel - Ingold, 1992] or 2-celled pieces after the fragmentation of the ustidium [*U. maydis* (DC.) Corda - Ingold, 1983, as *U. zeae*], but the ustidium is always prostrate on the medium (Ingold, 1983, 1984, 1987a, b, 1988, 1989b, 1992, using an analogous term basidium).

The species of *Anthracoidea* are homothallic and pseudohomothallic and the type of ustospore germination of this genus is different from *Ustilago-* and *Microbotryum*-types (Kukkonen, 1963, 1964; Kukkonen & Raudaskoski, 1964; Vánky, 1987; Ingold, 1989a). According to Nannfeldt (1979) the germination of the spores by a 2-celled "probasidium" is the crucial character which makes *Anthracoidea* unique amongst its allies. Zambettakis (1977) proposed a new family Anthracoideaceae Zambett., nom. nud., based on an intermediate type of behaviour of the "promycelium" nuclei. According to Ingold (1989a, b, 1992) the members of *Anthracoidea* have **2-celled, aerial ustidia** and this large genus should not be included in Ustilaginaceae.

The monotypic genus *Planetella* Savile is closely related to *Anthracoidea*. The members of both genera are parasites on Cyperaceae. They have xeromorphic sori in the scattered ovaries forming black, hard, rounded bodies, when young invested by whitish peridium which flakes away to expose the black, agglutinated to semi-powdery spore mass (Vánky, 1994). The germination of ustospores of *Planetella* is unknown but it is logically to be of *Anthracoidea*-type, i.e., with 2-celled ustidia (see also Vánky, 1994, p. 18). For these two genera a new family Anthracoideaceae must be erected. The diagnosis of the family follows.

Anthracoideaceae Denchev, **fam. nov.**

Phylum Ustomycota, Ordo Ustilaginales. Germinatio ustosporarum in ustidiis aëreus, 2-cellularibus.
Genus typicus: *Anthracoidea* Bref., Untersuch. Gesammtgeb. Mykol., **12(3):** 144. 1895.

Phylum Ustomycota, Order Ustilaginales. Ustilospore germination results in aerial, 2-celled ustidia.
Type genus: *Anthracoidea* Bref.

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Tulasne L.-R. & C. Tulasne. 1847. Mémoire sur les Ustilaginées comparées aux Urédinées. - Ann. Sci. Nat. Bot., Sér. 3, **7:** 12-127.

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NEW COMBINATIONS IN *BAUHINUS* (MICROBOTRYACEAE)

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ABSTRACT: The validation of the name *Bauhinus* is discussed. Thirty-four new combinations in *Bauhinus* are proposed.

KEYWORDS: ustomycetes, taxonomy, *Bauhinus*, Microbotryaceae, Ustilaginales.

INTRODUCTION

The genus *Ustilago* is the largest genus in the Ustilaginales with more than 400 species (Vánky, 1994) on a great number of dicotyledon and monocotyledon plants. According to Piepenbring et al. (1996) host range, soral and ustospore morphology, germination, cultural behaviour, physiology, ultrastructure, and molecular biology show a huge variety of character states among *Ustilago* spp. Nannfeldt (1959) pointed out the necessity of separation of purple-spored smuts on

Polygonaceae, Caryophyllaceae, Portulacaceae, etc., which form a natural group. Deml & Oberwinkler (1982) reinstated the genus *Microbotryum* for anthericolous species on Caryophyllaceae. According to Deml (1986) the *Ustilago* spp. on monocotyledons develop "basidiospores" on sterigmata while *Ustilago* spp. on dicotyledons develop sessile "basidiospores".

VALIDATION OF THE NAME *BAUHINUS*

Moore (1992) proposed the new genus *Bauhinus* for all dicot smuts of *Ustilago*. Vánky (1993) reduced *Bauhinus* to a synonym of *Microbotryum* because the species of *Microbotryum* Léveille, 1847, including the type, were parasites on dicotyledonous plants. According to **Article 63.1.** of the Berlin ICBN the name *Bauhinus* was **nomenclaturally superfluous when published**. Recently Moore (1996a, b) presented a new taxonomic scheme of the ustomycetes. The parasitic Ustilaginales was divided between the Ustilaginaceae, for species on monocots, and the newly described family Microbotryaceae, for species on dicots. Microbotryaceae was treated as "currently comprises two genera": *Bauhinus* {type species *Ustilago tragopogonis-pratensis* Pers.} on Polygonaceae, Dipsacaceae, and Compositae, and *Microbotryum* on Caryophyllaceae. When published the basionym of *Bauhinus* was legitimate. After dividing *Ustilago* species on dicots between the *Microbotryum* for species on Caryophyllaceae and the *Bauhinus* for species on other dicot families the taxonomic scheme is altered. In that case the genus *Bauhinus* **becomes correct** and it is in accordance with **Article 52.3.** of the Tokyo ICBN.

The sorus and ustospore morphology of the ovariicolous *Ustilago* species on Caryophyllaceae differ from those of the anthericolous *Ustilago* species on Caryophyllaceae; there are also ovariicolous *Ustilago* species on other dicot hosts. On the other hand, the main character for the separation of the genus *Microbotryum* is the type of ustospore germination which is different from the *Ustilago*-type. The type of the germination of the ovariicolous *Ustilago* species on Caryophyllaceae is unknown. In this connection I treat the species of *Microbotryum* more strictly than Moore (1996a), i.e. as limited to anthericolous smuts (Deml & Oberwinkler, 1982; Sholz & Sholz, 1988; Vánky, 1994). The ovariicolous *Ustilago* species on Caryophyllaceae must be included in *Bauhinus* (Denchev, in press).

NEW COMBINATIONS IN *BAUHINUS*

Moore (1992) described the genus *Bauhinus* for all *Ustilago* spp. on dicotyledons but made only six new combinations: *B. anomalus* (J. Kunze) R.T. Moore, *B. scabiosae* (Sowerby) R.T. Moore, *B. scorzonerae* (Alb. & Schwein.) R.T. Moore, *B. tragopogonis-pratensis* (Pers.) R.T. Moore, *B. utriculosus* (Nees) R.T. Moore, *B. vinosus* (Tul. & C. Tul.) R.T. Moore. Thirty-four new combinations in *Bauhinus* are proposed here.

Bauhinus avicularis (Liro) Denchev, *comb. nov.*
Basionym: *Ustilago avicularis* Liro, Ann. Acad. Sci. Fenn., Ser. A, **17(1):** 18. 1924.
Bauhinus betonicae (Beck) Denchev, *comb. nov.*
Basionym: *Ustilago betonicae* Beck, Verh. K. K. Zool.-Bot. Ges.(Wien), **30:** 10. 1881.
Bauhinus bistortarum (DC.) Denchev, *comb. nov.*
Basionym: *Uredo bistortarum* DC., Fl. franç., Ed. 3, **6:** 76. 1815.
Synonym: *Ustilago bistortarum* (DC.) Körn., Hedwigia, **16:** 38. 1877.
Bauhinus bosniacus (Beck) Denchev, *comb. nov.*
Basionym: *Ustilago bosniaca* Beck, Ann. K. K. Naturhist. Hofmus., **9:** 121. 1894.

Bauhinus calandriniae (G. P. Clinton) Denchev, *comb. nov.*
Basionym: *Ustilago calandriniae* G. P. Clinton, Proc. Boston Soc. Nat. Hist., **31:** 378. 1904.
Bauhinus cardui (A. Fischer v. Waldh.) Denchev, *comb. nov.*
Basionym: *Ustilago cardui* A. Fischer v. Waldh., Bull. Soc. Imp. Naturalistes Moscou, **40:** 255. 1867.
Bauhinus cephalariae (Vánky) Denchev, *comb. nov.*
Basionym: *Ustilago cephalariae* Vánky, Mycotaxon, **18:** 334. 1983.
Bauhinus cichorii (H. Sydow) Denchev, *comb. nov.*
Basionym: *Ustilago cichorii* H. Sydow, Ann. Mycol., **27:** 413. 1929.
Bauhinus claytoniae (Shear) Denchev, *comb. nov.*
Basionym: *Ustilago claytoniae* Shear, Bull. Torrey Bot. Club, **34:** 317. 1907.
Bauhinus cordae (Liro) Denchev, *comb. nov.*
Basionym: *Ustilago cordae* Liro, Ann. Acad. Sci. Fenn., Ser. A, **17(1):** 12. 1924 (sub *U. Cordai*).
Synonym: *Microbotryum cordae* (Liro) Deml & Prillinger, in Prillinger, Deml, Dörfler, Laaser & Lockau, Bot. Acta, **104:** 10. 1991.
Bauhinus flosculorum (DC.) Denchev, *comb. nov.*
Basionym: *Uredo flosculorum* DC., Fl. franç., Ed. 3, **6:** 79. 1815.
Synonym: *Ustilago flosculorum* (DC.) Fr., Syst. mycol., etc., **3(2):** 518. 1832.
Bauhinus gayophyti (Harkn.) Denchev, *comb. nov.*
Basionym: *Ustilago gayophyti* Harkn., Bull. Calif. Acad. Sci., **1:** 36. 1884.
Bauhinus goeppertianus (Schröter) Denchev, *comb. nov.*
Basionym: *Ustilago goeppertiana* Schröter, in Cohn, Krypt.-Fl. Schles., **3(1):** 272. 1887.
Bauhinus intermedius (Schröter) Denchev, *comb. nov.*
Basionym: *Ustilago intermedia* Schröter, in Rabenh., Hedwigia, **12:** 149. 1873.

Bauhinus koenigiae (Rostrup) Denchev, *comb. nov.*
Basionym: *Ustilago koenigiae* Rostrup, Meddel. Grønland, **3:** 532. 1888.
Bauhinus kuehneanus (R. Wolff) Denchev, *comb. nov.*
Basionym: *Ustilago kuehneana* R. Wolff, Bot. Zeitung (Berlin), **32:** 815. 1874.
Bauhinus marginalis (DC.) Denchev, *comb. nov.*
Basionym: *Uredo bistortarum* DC. β *marginalis* DC., Fl. franç., Ed. 3, **6:** 76. 1815.
Synonym: *Ustilago marginalis* (DC.) Lév., in d'Orbigny, Dict. Univ. Hist. Nat., 12: 778. 1849.
Bauhinus morinae **(**Padw. & A. Khan) Denchev, *comb. nov.*
Basionym: *Ustilago morinae* Padw. & A. Khan, Mycol. Pap., **10:** 1. 1944.
Bauhinus nannfeldtii (Liro) Denchev, *comb. nov.*
Basionym: *Ustilago nannfeldtii* Liro, Mycotheca fennica, die Etikketen, Nos. 301-600, p. 109. 1939.
Bauhinus nelsonianus (Savile) Denchev, *comb. nov.*
Basionym: *Ustilago nelsoniana* Savile, in Savile & Parmelee, Mycologia, **48:** 585. 1956.
Bauhinus nepalensis (Liro) Denchev, *comb. nov.*
Basionym: *Ustilago nepalensis* Liro, Ann. Acad. Sci. Fenn., Ser. A, **17(1):** 184. 1924.
Bauhinus onopordi (Vánky) Denchev, *comb. nov.*
Basionym: *Ustilago onopordi* Vánky, Mycotaxon, **41:** 487. 1991.
Bauhinus oxalidis (Ellis & Tracy) Denchev, *comb. nov.*
Basionym: *Ustilago oxalidis* Ell. & Tracy, J. Mycol., **6:** 77. 1890.
Bauhinus parlatorei (A. Fischer v. Waldh.) Denchev, *comb. nov.*
Basionym: *Ustilago parlatorei* A. Fischer v. Waldh., Hedwigia, **15:** 177. 1876.
Bauhinus pinguiculae (Rostrup) Denchev, *comb. nov.*

Basionym: *Ustilago pinguiculae* Rostrup, Festskr. Bot. Foren. Kjøbenhavn, **12(4):** 144. 1890.

Bauhinus piperii (G. P. Clinton) Denchev, *comb. nov.*

Basionym: *Ustilago piperii* G. P. Clinton, Proc. Boston Soc. Nat. Hist., **31:** 382. 1904.

Bauhinus pustulatus (DC.) Denchev, *comb. nov.*

Basionym: *Uredo bistortarum* DC. α *pustulata* DC., Fl. franç., Ed. 3, **6:** 76. 1815.

Synonym: *Ustilago pustulata* (DC.) Winter, Hedwigia, **19:** 109. 1880.

Bauhinus reticulatus (Liro) Denchev, *comb. nov.*

Basionym: *Ustilago reticulata* Liro, Ann. Acad. Sci. Fenn., Ser. A, **17(1):** 20. 1924.

Synonym: *Ustilago utriculosa* sensu Tul. & C. Tul., Ann. Sci. Nat. Bot., Sér. 3, **7:** 102. 1847; non *Caeoma utriculosum* Nees, Syst. Pilze, p. 14. 1817 [q.e. *Sphacelotheca hydropiperis* (Schumacher) de Bary, Lindeberg, 1959], nec ***Bauhinus utriculosus*** (Nees) R.T. Moore, Mycotaxon, **45:** 99. 1992 [based on *Caeoma utriculosum*].

Bauhinus rhei (Zundel) Denchev, *comb. nov.*

Basionym: *Tilletia rhei* Zundel, Mycologia, **36:** 410. 1944.

Synonym: *Ustilago rhei* (Zundel) Vánky & Oberwinkler, Nova Hedwigia, Beihefte, **107:** 72. 1994.

Bauhinus scolymi (Roum. & Trabut ex Juel) Denchev, *comb. nov.*

Basionym: *Ustilago scolymi* Roum. & Trabut ex Juel, Bull. Soc. Mycol. France, **17:** 257. 1901.

Bauhinus stygius (Liro) Denchev, *comb. nov.*

Basionym: *Ustilago stygia* Liro, Ann. Acad. Sci. Fenn., Ser. A, **17(1):** 25. 1924.

Bauhinus succisae (Magnus) Denchev, *comb. nov.*

Basionym: *Ustilago succisae* Magnus, Hedwigia, **14:** 17. 1875.

Bauhinus thlaspeos (Beck) Denchev, *comb. nov.*

Basionym: *Tilletia thlaspeos* Beck, Verh. K. K. Zool.-Bot. Ges. Wien, **35:** 362. 1886.

Synonym: *Ustilago thlaspeos* (Beck) Lagerh., in Sydow, Ust., No. 118. 1897.

Bauhinus warmingii (Rostrup) Denchev, *comb. nov.*

Basionym: *Ustilago warmingii* Rostrup, Bot. Tidsskr., **15:** 229. 1886.

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NOTES ON HAWAIIAN CONIOPHORACEAE

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SUMMARY

Eleven species of wood-rotting basidiomycetes in the Coniophoraceae are reported from the state of Hawai'i. *Coniophora kauaiensis* is described as new. *Gyrodontium versicolor* is reported from the United States for the first time. Seven species are reported on introduced conifers and ten are reported on native or introduced hardwoods. All are confirmed or probable brown rot fungi and have an important role in decomposition and formation of stable brown rot residues as a soil component in Hawaiian forest ecosystems.

Burt (1917) and Ginns (1982), in their monographs of *Coniophora*, do not list any collections from Hawai'i. Burt (1923) has no Coniophoraceae in a paper on higher fungi of the Hawaiian Islands. Ginns (1978) provided detailed distribution records of nine species of *Leucogyrophana* but no records from Hawai'i are included. Raabe et al. (1981) in a checklist of plant diseases in Hawai'i list *Pseudomerulius curtisii* (as *Paxillus corrugatus* Atk. and *Paxillus curtisii* Berk.) but no other Coniophoraceae. The latter record also appears in Farr et al. (1989) who list no other Hawaiian records of Coniophoraceae. Gilbertson and Adaskaveg (1993) reported *Tapinella panuoides* from Hawai'i. Apparently these are the only previous reports of Coniophoraceae from Hawai'i. Collections by the authors from 1991 to the present have included numerous specimens of Coniophoraceae and these are reported in this paper.

Fungi in the Coniophoraceae as currently conceived cause brown rots of wood. They selectively remove cellulose and other polysaccharides from wood cell walls and leave a residue of slightly modified lignin. This brown rot residue is highly stable in nature and becomes an important soil component with significant ecological functions in forest ecosystems (Larsen et al., 1980). Brown rot fungi have been reported to occur mainly in temperate conifer forests (Gilbertson and Ryvarden, 1986) and it was surprising to find them relatively well represented in Hawaiian forests as no conifers are native to the islands. In this study species of Coniophoraceae were found in all plantations of exotic conifers examined. However, the same fungi were generally found on native and exotic hardwoods as well and some were collected on hardwoods only. Considering that the introduced conifers have been in Hawai'i for a relatively short time it is probable that most, if not all, of the fungi reported here were established in Hawai'i on hardwoods prior to the introduction of conifers. Our field work has indicated that brown rot fungi in the Polyporaceae and other families of basidiomycetes are also prominent components of Hawaiian forest ecosystems and brown rot fungi in general are much more common and ecologically important in Hawai'i than one would expect.

Authors of fungal names follow Kirk and Ansell (1992). Capitalized color names are from Ridgway (1912). Specimens are deposited at ARIZ.

KEY TO HAWAIIAN CONIOPHORACEAE

1. Basidiocarps pileate, sessile or effused-reflexed 2
1. Basidiocarps resupinate 4

2. Hymenophore hydnaceous with olivaceous, cylindric teeth; pilei imbricate, up to 1.5 cm thick . . . . ***Gyrodontium versicolor***
2. Hymenophore lamellate to ridged 3

3. Hymenophore lamellate; basidiospores ellipsoid to ovoid, dextrinoid in Melzer's reagent . . . . ***Tapinella panuoides***
3. Hymenophore ridged: basidiospores oblong to short-cylindric, negative in Melzer's reagent . . . . ***Pseudomerulius curtisii***

4. Hymenophore orange, merulioid, fleshy; basidiospores pale yellowish, 6-7 x 4-5 µm . . . . ***Leucogyrophana mollusca***
4. Hymenophore olivaceous to purplish brown, smooth, merulioid, or poroid; basidiospores brown at maturity, 7.5-16 x 5.5-9 µm 5

5. Hymenophore strongly merulioid to poroid; hyphae with abundant and conspicuous single clamps 6
5. Hymenophore smooth to slightly wrinkled; hyphae mostly simple-septate, scattered single to multiple clamps often present 7

6. Hymenial surface merulioid, dark purplish brown on a pinkish buff, rhizomorphic mycelial mat . . . . ***Serpula himantioides***
6. Hymenial surface poroid, grayish brown to blackish brown on drying; margin not rhizomorphic . . . . ***Serpula incrassata***

7. Septate, incrusted cystidia present, projecting to 150 µm . . . ***Coniophora olivacea***
7. Septate, incrusted cystidia not present 8

8. Hymenial surface smooth, dark purplish brown; basidiospores 8-10.5 x 5-7 μm; clamps absent on all hyphae . . . . ***Coniophora hanoiensis***
8. Hymenial surface smooth to wrinkled, olivaceous to purplish brown; basidiospores 8-14 x 6-9 μm; single to multiple clamps present on some hyphae 9

9. Basidiospores moderately to strongly dextrinoid in Melzer's reagent . . . . ***Coniophora arida***
9. Basidiospores negative or weakly dextrinoid in Melzer's reagent 10

10. Basidiocarps thin, not fleshy when fresh; hymenial surface smooth . . . . ***Coniophora kauaiensis***
10. Basidiocarps thick, fleshy when fresh; hymenial surface with shallow folds or wrinkles . . . . ***Coniophora puteana***

ANNOTATED LIST OF SPECIES

CONIOPHORA ARIDA (Fr.) P. Karst. var. ***arida*** Fig. 1
Not. Sällsk. Fauna Fl. Fenn. Förh. 9:370. 1868.
Basidiocarps annual or persisting, resupinate, effused up to several cm, arid, thin, adherent but easily scraped off substratum; hymenial surface smooth, becoming olivaceous brown as spores mature (Isabella Color to Tawny-Olive or Light Brownish Olive); margin thinning out, fimbriate, cream to buff (Cream Buff to Deep Colonial Buff, Honey Yellow, or Chamois), usually with conspicuous hyphal strands or cordons radiating out over the substrate; subiculum thin, white to cream; hyphal system monomitic; subicular hyphae hyaline, thin- to firm-walled, mostly simple-septate, 3-5 μm in diam, with occasional branching, also some with single, double, or multiple clamps, 5-9.5 μm in diam; basidia utriform or narrowly clavate to cylindric, elongated, 4-sterigmate, up to 80 μm long, 8-10 μm in diam; basidiospores ellipsoid, yellowish brown in KOH, smooth, thick-walled, moderately to strongly dextrinoid in Melzer's reagent, 7.5-12 x 5.5-8 μm, with a prominent peg-like apiculus. Associated with a brown rot. Not previously reported from Hawai'i. RLG 18848, 18855, 20462, 20474, 20475, on 'ōhi'a lehua, Devastation Trail, Cinders area, HVNP, Ka'ū Dist., Hawai'i; RLG 19073, 19076, 19081, on slash pine, Hosmer Grove Ranger Station, Haleakalā Highway, Maui; RLG 19110, on slash pine, Polipoli State Recreation Area, Kula Forest Reserve, Maui; RLG 21065, 21263, 21266, 21267, 21272, 21277, 21302, 21305, 21309, 21319, on slash pine, Mākaha Rd., Waimea Dist., Kaua'i.

CONIOPHORA HANOIENSIS Pat. Fig. 2
Bull. Soc. Mycol. France 23:76. 1907.
Basidiocarps resupinate, effused up to 20 cm, persistent, felt-like in consistency and easily broken out in chunks, up to 3 mm thick; hymenial surface smooth to shallowly tuberculate with widely spaced tubercules, dark purplish brown (Dark Vinaceous-Drab to Fuscous); margin abrupt and concolorous or thinning out to minutely fimbriate and cream colored to pale buff; hyphal system monomitic; subicular hyphae thin- to moderately thick-walled, slightly pigmented, simple septate, with occasional branching, 3-6 μm in diam, no single, double, or multiple clamps seen; cystidia absent; basidia

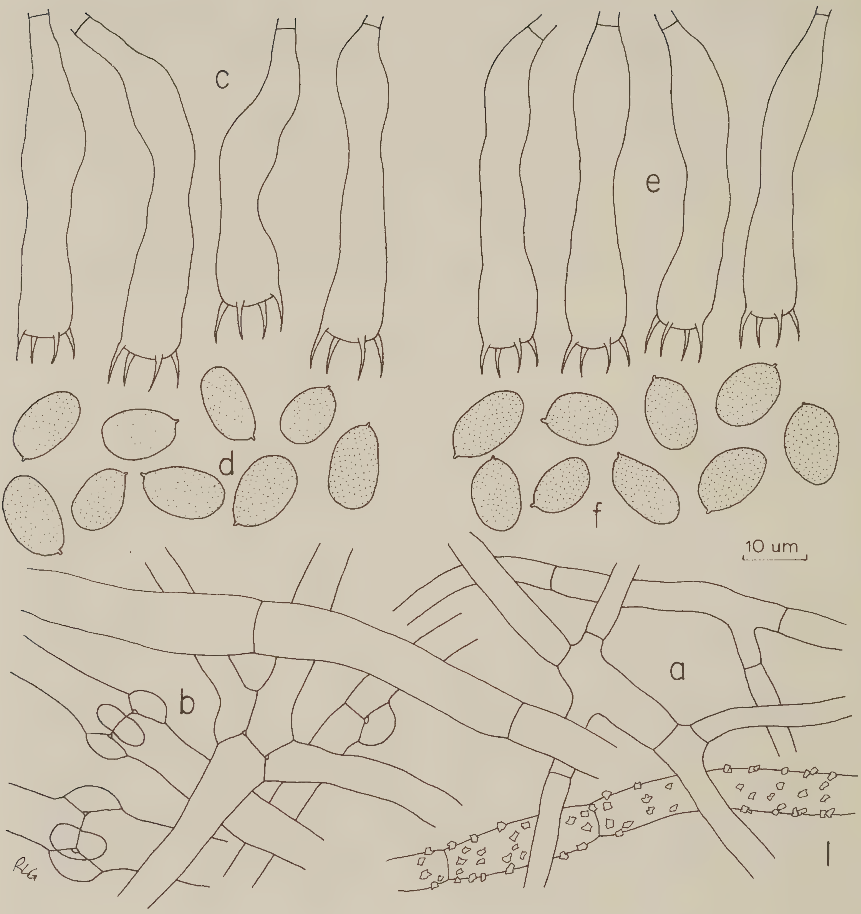

Fig. 1. *Coniophora arida*. a, simple-septate hyphae from RLG 19073; b, hyphae with single to multiple clamps from 19073; c, basidia from 19073; d, basidiospores from 19073; e, basidia from RLG 18855; f, basidiospores from 18855.

narrowly clavate to subcylindric, 4-sterigmate, 36-50 x 6.5-8 μm, simple-septate at the base; basidiospores ellipsoid to ovoid, dark yellowish brown in KOH and phloxine, smooth, thick-walled, dextrinoid in Melzer's reagent, with a small, peg-like apiculus. Associated with a brown rot. This is a widely distributed fungus in the Southern Hemisphere and Ginns (1982) reports it from South Africa, Singapore, Thailand, and Australia. This is the first report from Hawai'i. RLG 17869, on horsetail casuarina, Waipi'o Valley, Hāmākua Dist., Hawai'i; RLG 18223, 18918, on robusta eucalyptus, Honokaia Boy Scout Camp, Hāmākua Dist., Hawai'i.

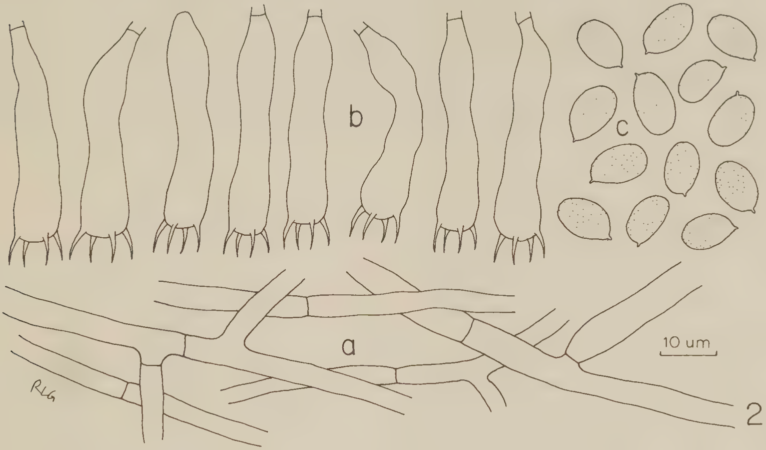

Fig. 2. *Coniophora hanoiensis* (RLG 18223). a, subicular hyphae; b, basidia; c, basidiospores.

CONIOPHORA KAUAIENSIS Gilb. & Hemmes, sp. nov. Fig. 3
Fructificatio resupinata, tenuis, superficies hymenii laeve, cinereo-olivacea ad olivaceo-brunnea; margine cremeo-bubalina; systema hypharum monomiticum; hyphae hyalinae, pro parte maxima simple-septatae, aliquot cum uni- vel multifibulatae; cystidia nulla; cystidiolae adsunt; basidia utriforme vel cylindricae, 50-75 x 7-11 μm; basidiosporae ellipsoidae vel subglobosae, pallido-brunnea, laeve, crassitunicatae, nondextrinoideae, 8-14 x 5-9.5 μm. Holotype- RLG 21231, on *Acacia koa*, Miloli'i Rd., Ku'ia Nat. Area Reserve, Waimea Dist., Kaua'i, Jan. 10, 1996 (BPI, isotype ARIZ).

Basidiocarps resupinate, effused up to 10 cm, adherent; hymenial surface smooth, grayish olivaceous to olivaceous brown (Saccardo's Olive to Olive Citrine or Light Brownish Olive or Buffy Olive to Buffy Citrine to Ecru-Olive); margin cream to buff (Ivory Yellow to Marguerite Yellow or Cream-Buff to Chamois or Deep Colonial Buff); hyphal system monomitic; hyphae hyaline, thin to firm-walled, simple-septate, with occasional to frequent branching, mostly 3-7 μm in diam, also some with single, double, or multiple clamps, 4-10 μm in diam, some swollen up to 17 μm at the septa with multiple clamps; cystidia absent; narrowly fusoid to hyphoid cystidioles present among the basidia, mostly not projecting, 30-60 x 2-5 μm; basidia urniform or narrowly clavate to cylindric, 4-sterigmate, 50-75 x 7-11 μm at maturity, simple-septate at the base; basidiospores highly variable in size and shape, narrowly ellipsoid to fusoid, broadly ellipsoid or even subglobose, pale brown in KOH, smooth, thick-walled, negative in Melzer's reagent, appearing essentially the same as in KOH, 8-12.5 (-14) x 5-8 (-9.5). This taxon is

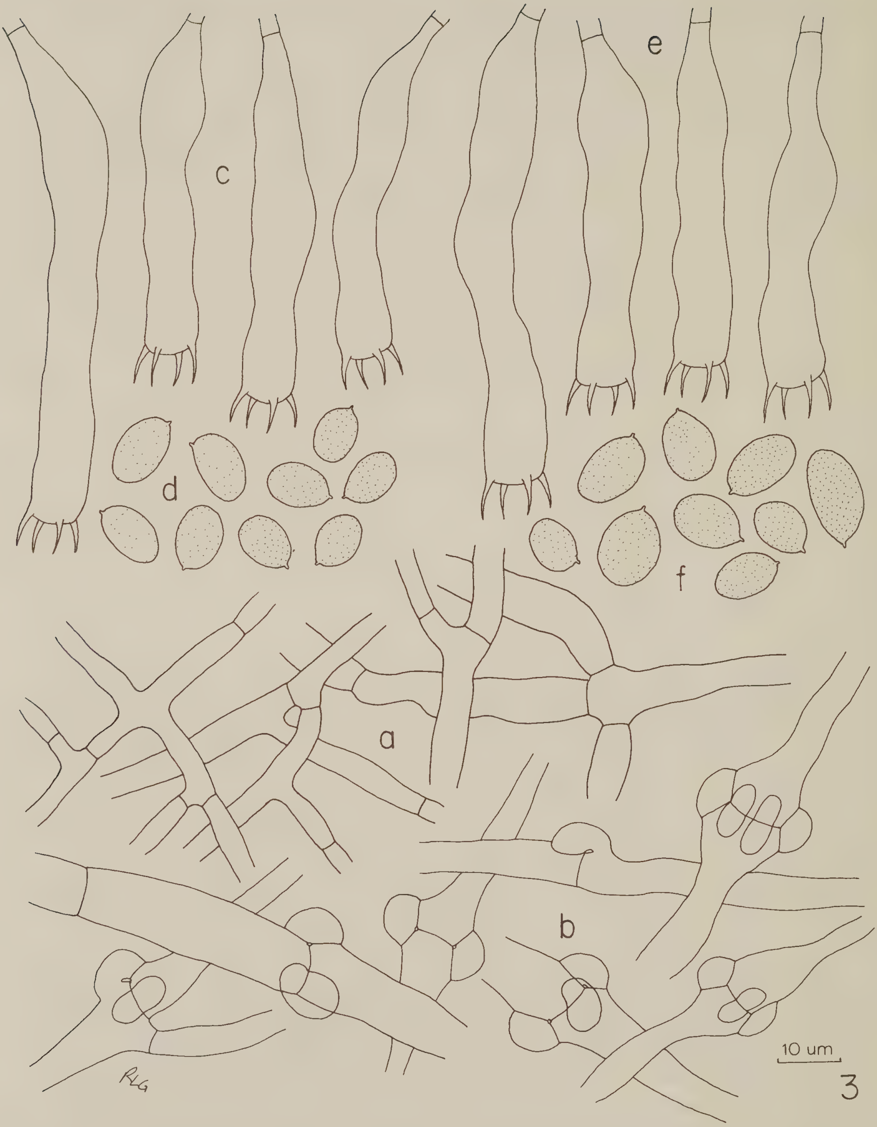

Fig. 3. *Coniophora kauaiensis*. a, simple-septate hyphae from RLG 21157; b, hyphae with single to multiple clamps from 21157; c, basidia from RLG 21231; d, basidiospores from 21231; e, basidia from RLG 20544; f, basidiospores from 20544.

macroscopically distinguishable from *C. arida* by its more compact and more grayish olivaceous hymenial surface. It also differs from *C. arida* in having spores that are negative in Melzer's reagent. It differs from *C. puteana* in having a thin, membranous basidiocarp and a smooth hymenial surface. RLG 20544, on slash pine, Mākaha Rd., Waimea Dist., Kaua‘i; RLG 21078, on Monterey cypress, Kōke‘e Cabin Camp, Kōke‘e State Park, Waimea Dist., Kaua‘i; RLG 21157, on black wattle acacia, Pu‘uka ‘Ohelo Berry Flat Trail, Kōke‘e State Park, Waimea Dist., Kaua‘i; RLG 21231, on koa, Miloli’i Rd., Ku’ia Nat. Area Reserve, Waimea Dist., Kaua‘i (Type).

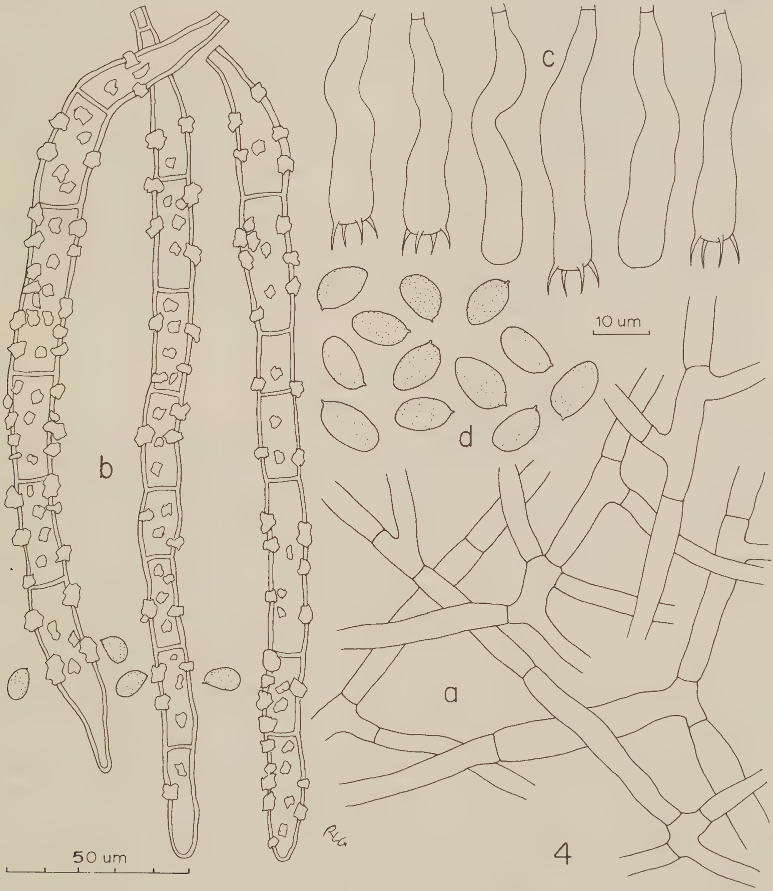

Fig. 4. *Coniophora olivacea* (RLG 21319). a, subicular hyphae; b, cystidia drawn at smaller scale; c, basidia; d, basidiospores.

CONIOPHORA OLIVACEA (Fr.:Fr.) P. Karst. Fig. 4
Bidrag Kännedom Finlands Natur Folk 37:162. 1882.
Basidiocarps resupinate, effused up to 10 cm; hymenial surface smooth, clearly cystidiate under a 30x lens, dark olivaceous brown to purplish brown (Olive Brown to Clove Brown or Sepia); margin thinning out, cream colored, with radiating, loosely arranged hyphal strands, up to 3 mm wide; hyphal system monomitic, subicular hyphae thin- to firm-walled, hyaline to faintly pigmented, simple-septate, with frequent branching, mostly 2.5-5 μm in diam but some up to 8μm, distinct strands or cordons of parallel hyphae present in subiculum, no clamps seen on subicular hyphae; hyphae of pale marginal tissue mostly 3-8 μm in diam but some up to 12 μm, simple-septate, no clamps seen on hyphae from marginal tissue; cystidia prominent, cylindric or tapering at the apex, thin- to firm-walled, with several simple septa, lightly to heavily incrusted with coarse, irregular crystalline material, up to 210 μm long, 10-15 μm in diam, projecting up to 150 μm; basidia clavate, 4-sterigmate, 36-40 x 7-8 μm, simple-septate at the base; basidiospores ellipsoid or tapered to the apex and pip-shaped, dark brown in KOH, smooth, thick-walled, dextrinoid in Melzer's reagent, 8-11 x 5-7.5 μm. Associated with a brown rot. This is a widely distributed fungus in the northern and southern hemispheres and is particularly common in North Temperate conifer forests. Not previously reported from Hawai'i. RLG 19297, on Monterey cypress, RLG 19298, on Tasmanian blue gum, Kamakou Forest Preserve, Moloka'i; RLG 20654, on saligna eucalyptus, Keāhua Arboretum, Kawaihau Dist., Kaua'i; RLG 21319, on slash pine, Mākaha Rd., Waimea Dist., Kaua'i.

CONIOPHORA PUTEANA (Schumach.:Fr.) P. Karst. Fig. 5
Not. Sällsk. Fauna Fl. Fenn. Förh. 9:370. 1868.
Basidiocarps annual or persisting, resupinate, effused up to 20 cm, adherent, when fresh soft and fleshy; hymenial surface thrown up into folds or wrinkles, whitish cream at first, becoming pale ochraceous gray to purplish brown and finally darker as spores mature; margin whitish to cream, thinning out with loosely arranged coarse to fine hyphal strands or cordons radiating out over the substratum; subiculum cream colored, thin, soft; hyphal system monomitic; subicular hyphae hyaline, thin- to firm-walled, mostly simple-septate, with occasional branching, 2-8 μm in diam, also some with single, double or multiple clamps, up to 11 μm in diam, sometimes strongly ampullate up to 20 μm at the septa with multiple clamps; cystidia absent; narrowly fusoid to hyphoid sterile elements abundant among the basidia, often wavy or contorted, branched or lobed, thin-walled, 2-4 μm in diam, up to 80 μm long; basidia narrowly clavate to utriform with a slightly swollen base, 4-sterigmate, 30-100 (-120) x 7-9 (-10) μm, simple-septate at the base; basidiospores narrowly to broadly ellipsoid, pale yellowish brown in KOH, smooth, thick-walled with a shallow germ pore at the apical end, negative to weakly dextrinoid in Melzer's reagent, 8-13 (-14) x 5-8 (-9) μm, with a small peg-like apiculus. Associated with a brown rot. Not previously reported from Hawai'i. RLG 18713, on wingleaf soapberry, Kīpuka Kī, HVNP, Ka'ū Dist., Hawai'i; RLG 21079, on Monterey cypress, Kōke'e Cabin Camp, Kōke'e State Park, Waimea Dist., Kaua'i; RLG 21305, on slash pine, Mākaha Rd, Waimea Dist., Kaua'i.

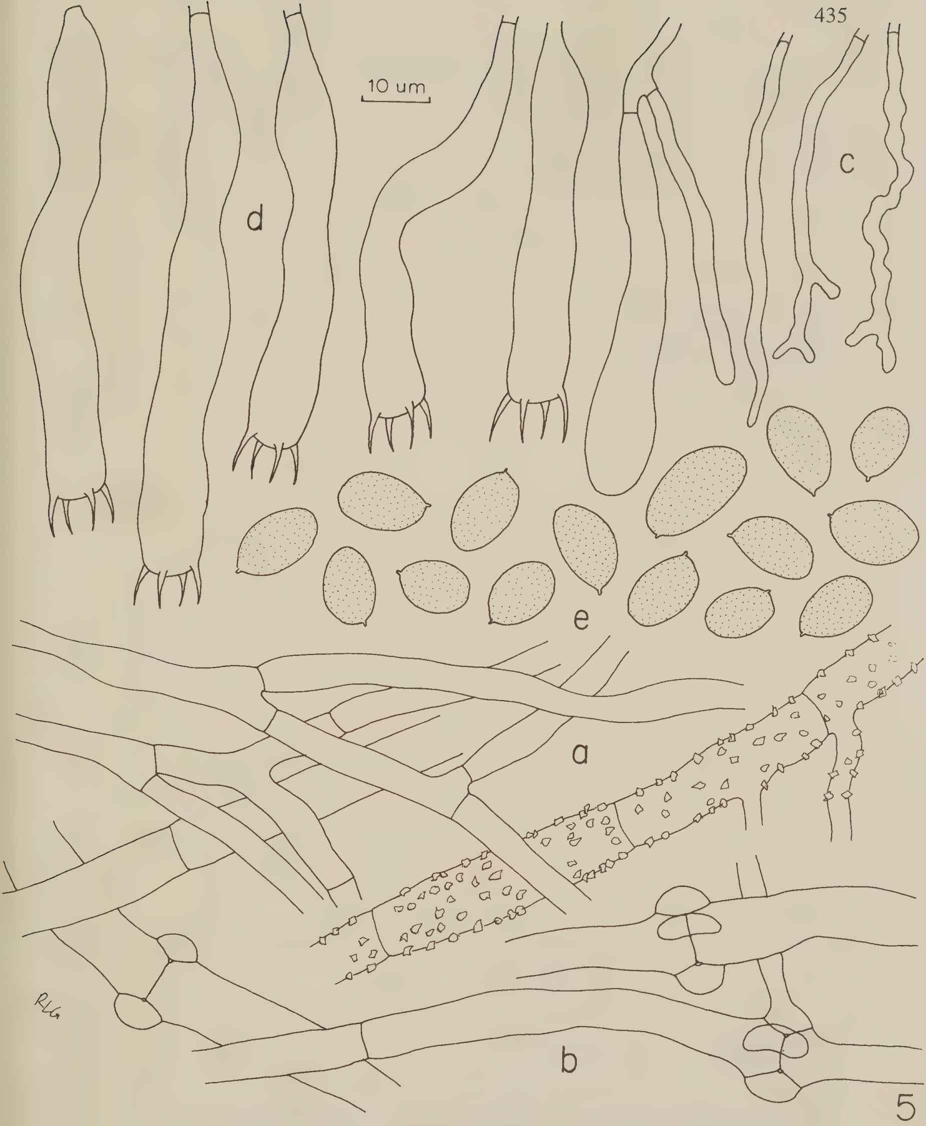

Fig. 5. *Coniophora puteana* (RLG 21079). a. simple-septate subicular hyphae; b, subicular hyphae with double or multiple clamps; c, slender simple and branched hymenial hyphidia; d, basidia; e, basidiospores.

GYRODONTIUM VERSICOLOR (Berk. & Br.) Maas Geest. Fig. 6
Persoonia 3:190. 1964.

Basidiocarps annual, pileate with numerous imbricate pilei on a common base; pilei

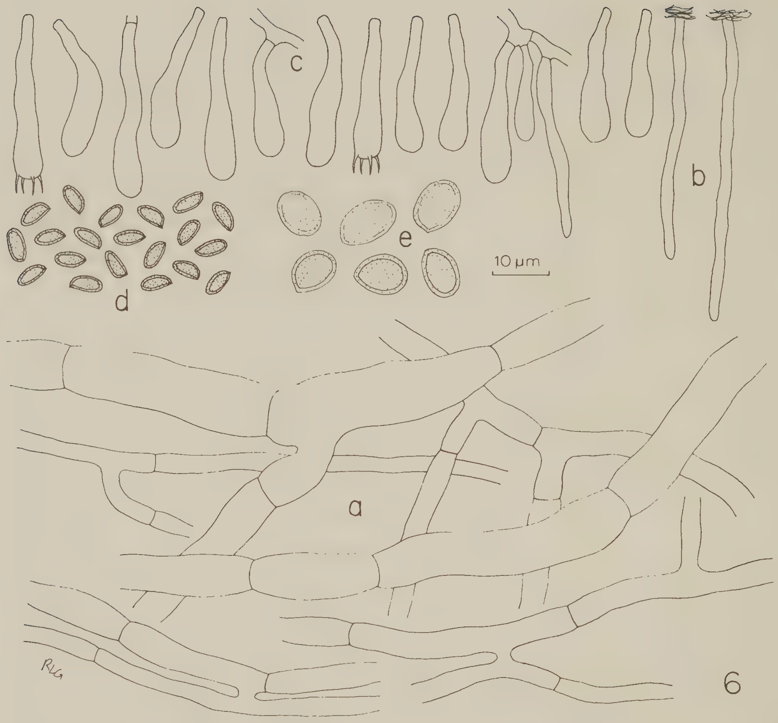

Fig. 6. *Gyrodontium versicolor* (RLG 21145). a, contextual hyphae; b, hyphoid hymenial hyphidia; c; basidia; d, basidiospores; e, chlamydospores from context.

dimidiate, applanate, up to 10 cm wide and 1.5 cm thick; pilear surface cream colored, azonate, finely tomentose; hymenophore hydnaceous, lower surface cream colored at the margin, then a zone of bright yellowish cream where teeth develop, then mature hymenophore with crowded, cylindric, olivaceous teeth up to 5 mm long; context cream-colored, soft-fibrous and easily pulled apart, azonate, homogeneous, up to 1 cm thick; hyphal system monomitic; contextual hyphae thin-walled, simple-septate, often ampullate at the septa, some wide hyphae up to 11 μm in diam; cystidia none; some hyphoid sterile elements present among basidia; basidia narrowly clavate, 4-sterigmate, 20-30 x 5-5.5 μm, simple-septate at the base; basidiospores oblong to narrowly ellipsoid, pale brownish in KOH, smooth, thick-walled, negative in Melzer's reagent, 4.5-5.5 x 2.5-3 μm; some chlamydospores also present in context, broadly ellipsoid, pale brownish in KOH, smooth, thick-walled, negative in Melzer's reagent, 8-11 x 6-7 μm. Associated with a brown rot. Not previously reported from Hawai'i or the continental United States. Reid (1963) describes this fungus as *Gyrodontium serpuloides* (P. Henn.) D.A. Reid. Maas Geesteranus (1964) later considered *Hydnum serpuloides* P. Henn., *Hydnum henningsii* Bres., *Hydnum merulioides* Berk. & Broome, *Hydnum polymorphum* Berk. & Broome, and *Boninohydnum pini* S. Ito & S. Imai to be synonyms of *G. versicolor*. RLG 21145, on koa, Nu'alolo Trail, Kōke'e State Park, Waimea Dist., Kaua'i.

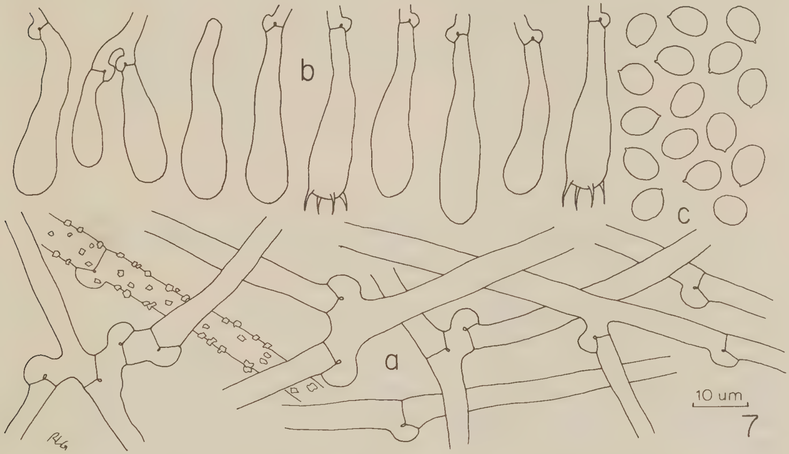

Fig. 7. *Leucogyrophana mollusca* (RLG 19010). a, subicular hyphae; b, basidia; c, basidiospores.

LEUCOGYROPHANA MOLLUSCA (Fr.) Pouzar Fig. 7
Česká Mykol. 12:33. 1958.

Basidiocarps resupinate, effused up to 10 cm, soft, fragile, easily separated from substratum; hymenial surface bright orange and soft and fleshy when fresh, strongly merulioid; margin white, thinning out to a loose network of strands and cordons radiating out over the substratum; subiculum white, soft-cottony to arachnoid, with strands and cordons obvious under a 30x lens; hyphal system monomitic; subicular hyphae hyaline, thin-walled, with clamps, with frequent branching, often from or adjacent to clamps, 3-6 μm in diam, some lightly incrusted; cystidia absent; basidia clavate, 4-sterigmate, 20-30 x 6-8 μm, with a basal clamp; basidiospores broadly ellipsoid, pale yellowish in KOH, smooth, thick-walled, negative in Melzer's reagent, 6-7 x 4.5-5 μm. Associated with a brown rot. Not previously reported from Hawai'i. RLG 19010, on 'ōhi'a lehua, Devastation Trail, Cinders Area, HVNP, Ka'ū Dist., Hawai'i; RLG 19387, on mango, Pohoiki Rd., Puna Dist., Hawai'i; RLG 21080, on Monterey cypress, Kōke'e Cabin Camp, Kōke'e State Park, Waimea Dist., Kaua'i.

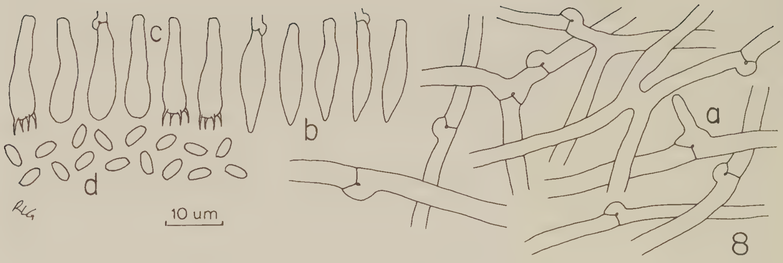

Fig. 8. *Pseudomerulius curtisii* (RLG 18210). a, contextual hyphae; b, fusoid cystidioles; c, basidia; d, basidiospores.

PSEUDOMERULIUS CURTISII (Berk.) Redhead & Ginns Fig. 8
Trans. Mycol. Soc. Japan 26:372. 1985.
Basidiocarps annual, sessile and dimidiate, effused-reflexed with a narrow pileus, or completely resupinate, sometimes with imbricate, dimidiate pilei up to 2 x 1 x .5 cm, soft when fresh, drying hard and rigid; pilear surface honey yellow to yellowish brown, tomentose to rough and scurfy, drying darker; hyphal system monomitic; hyphae thin-walled, hyaline, with clamps, 2-4.5 μm in diam; cystidia absent; fusoid cystidioles abundant, thin-walled, 15-18 x 3-4 μm, with a basal clamp; basidia narrowly clavate, closely packed and intermixed with cystidioles, 15-18 x 3.5-4.5 μm; basidiospores oblong to short-cylindric, hyaline, smooth, thin-walled, negative in Melzer's reagent, 3.5-4 x 1.5-2 μm. Associated with a brown rot. Reported from Hawai'i by Raabe et al. (1981, as *Paxillus corrugatus* and *Paxillus curtisii*) and Farr et al. (1989, as *Paxillus curtisii*). RLG 17095, on ʻōhiʻa lehua, Thurston Lava Tube, HVNP, Kaʻū Dist., Hawaiʻi; RLG 17207, on horsetail casuarina, MacKenzie State Park, Puna Dist., Hawaiʻi; RLG 18210, on robusta eucalyptus, Honokaia Boy Scout Camp, Hāmākua Dist., Hawaiʻi; RLG 20460, on ʻōhiʻa lehua, Devastation Trail, Cinders Area, HVNP, Kaʻū Dist., Hawaiʻi; RLG 21286, on slash pine, Mākaha Rd., Waimea Dist., Kauaʻi.

SERPULA HIMANTIOIDES (Fr.:Fr.) P. Karst. Fig. 9
Bidrag Kännedom Finlands Natur Folk 48:344. 1889.
Basidiocarps developing on fragile, pinkish cream, rhizomorphic mycelial mats, annual, resupinate, developing in scattered patches up to 10 cm wide, easily separated from substratum; hymenial surface shallowly merulioid, becoming dark brown as spores mature; hyphal system monomitic; hyphae mostly hyaline, thin-walled, with conspicuous clamps, 3-5 μm in diam; also some with dark brown contents, these also with clamps, up to 8 μm in diam; cystidia none; some fusoid to hyphoid cystidioles intermixed with the basidia; basidia clavate with an elongated, narrow base, 4-sterigmate, 50-85 x 9-10 μm, with a basal clamp; basidiospores ovoid, pale brown in KOH, smooth, thick-walled, weakly to moderately strongly dextrinoid in Melzer's reagent, 9-10.5 x 4.5-6 μm.

Associated with a brown rot. Not previously reported from Hawai'i. RLG 17619, on koa, Keanakolu Rd., North Hilo Dist., Hawai'i.

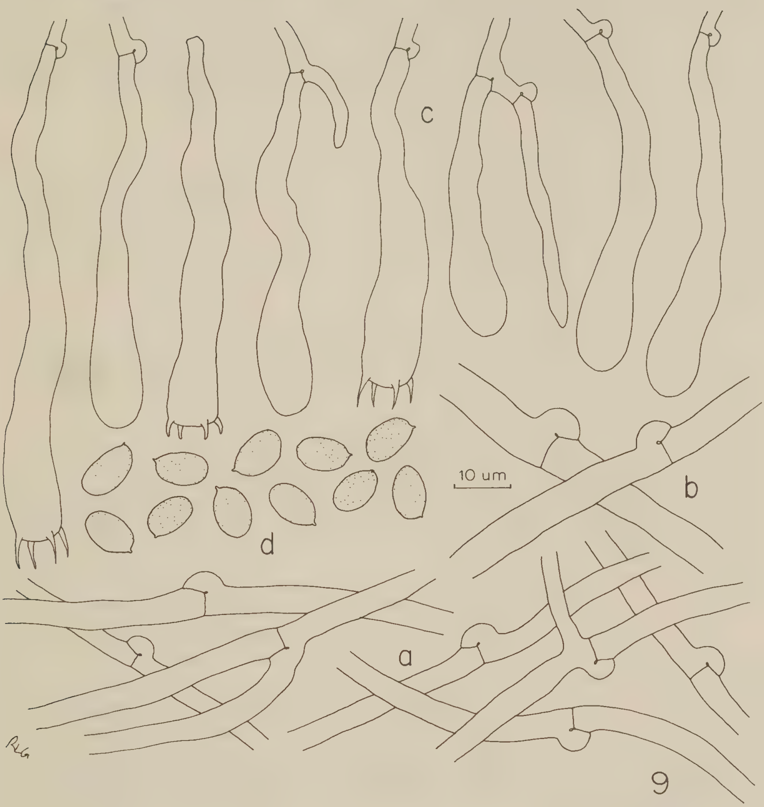

Fig. 9. *Serpula himantioides* (RLG 17619). a, hyaline subicular hyphae; b, pigmented subicular hyphae; c, basidia; d, basidiospores.

SERPULA INCRASSATA (Berk. & M.A. Curtis) Donk Fig. 10
Bull. Jard. Bot. Buitenzorg, Sér. III, 17:474. 1948.

Basidiocarps annual, resupinate, effused up to 10 cm, soft and easily separable when fresh; hymenial surface strongly merulioid and appearing polyporoid, cream to light buff or ochraceous at first, becoming darker grayish brown to blackish on drying, the pores irregular, 2-3 per mm; subiculum buff, soft-fibrous, up to 5 mm thick; tube layer drying dark brown to blackish, hard and brittle, contrasting sharply with the pale, soft subiculum; hyphal system monomitic; subicular hyphae hyaline, thin-walled, with abundant single clamps and some simple septa, 3-7 μm in diam; tramal hyphae similar, 3-5 μm in diam; cystidia absent; basidia clavate, 4-sterigmate, 30-50 x 8-9.5 μm, with a basal clamp; basidiospores broadly to narrowly ellipsoid, some slightly curved, pale brown in KOH, smooth, thick-walled, 9.5-12 (-14) x 5-7 μm. Associated with a brown rot. Not previously reported from Hawai'i. This is a major cause of decay in houses and other wooden structures in the continental United States and is rarely found in forest ecosystems. DEH PP-11, on loblolly pine, Kōke'e Cabin Camp, Kōke'e State Park, Waimea Dist., Kaua'i.

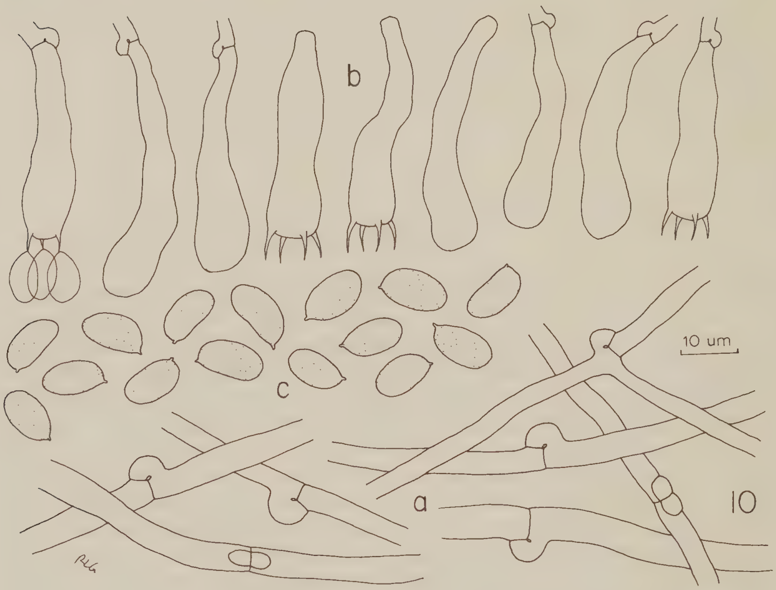

Fig. 10. *Serpula incrassata* (DEH PP-11). a, subicular hyphae; b, basidia; c, basidiospores.

TAPINELLA PANUOIDES (Batsch:Fr.) J.-E. Gilbert Fig. 11
Les Bolets, p. 68. 1931.

Basidiocarps annual, pileate, sessile, dimidiate to flabelliform, up to 7 x 4 x 1 cm, single or in confluent or imbricate clusters; pilear surface ochraceous-buff, smooth, finely tomentose to strigose at the base; gills pinkish buff, wavy, anastomosing, edges entire; hyphal system monomitic; hyphae hyaline, thin-walled, with clamps, 2-5 μm in diam; cystidia absent; basidia narrowly clavate, 4-sterigmate, 30-37 x 5-5.5 μm, with a basal clamp; basidiospores ellipsoid, pale yellowish in KOH, smooth, moderately to strongly dextrinoid in Melzer's reagent, 4-5 x 2.5-3.5 μm. Associated with a brown rot. Previously reported from Hawai'i on 'ōhi'a lehua by Gilbertson and Adaskaveg (1993).

RLG 18866, on ʻōhiʻa lehua, Devastation Trail, Cinders Area, HVNP, Kaʻū Dist., Hawaiʻi; RLG 21271, on slash pine, Mākaha Rd., Waimea Dist., Kauaʻi.

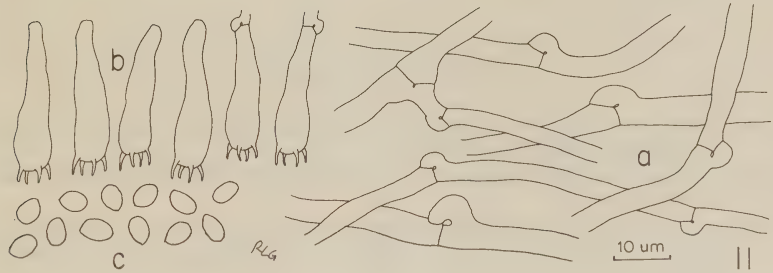

Fig. 11. *Tapinella panuoides* (RLG 18866). a, contextual hyphae; b, basidia; c, basidiospores.

HOST INDEX

(Botanical and common names of trees reported as substrates based on Little and Skolmen, 1989).

Acacia koa A. Gray; koa
    C. kauaiensis, G. versicolor, S. himantioides
Acacia mearnsii DeWild.; black wattle acacia
    C. kauaiensis
Casuarina equisetifolia L. ex J.R. & G. Forst.; horsetail casuarina
    C. hanoiensis, P. curtisii
Cupressus macrocarpa Hartw.; Monterey cypress
    C. kauaiensis, C. olivacea, C. puteana, L. mollusca
Eucalyptus globulus Labill.; Tasmanian blue gum
    C. olivacea
Eucalyptus robusta Sm.; robusta eucalyptus
    C. hanoiensis, P. curtisii
Eucalyptus saligna Sm.; saligna eucalyptus
    C. olivacea
Mangifera indica L.; mango, manako
    L. mollusca
Metrosideros polymorpha Gaud.; ʻōhiʻa lehua
    C. arida, L. mollusca, P. curtisii, T. panuoides
Pinus elliottii Engelm.; slash pine
    C. arida, C. kauaiensis, C. olivacea, C. puteana, P. curtisii, T. panuoides

Pinus taeda L.; loblolly pine
S. incrassata
Sapindus saponaria L.; wingleaf soapberry, mānele
C. puteana

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MYCOTAXON

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A NEW SPECIES OF *ASCOBOLUS* FROM TAIWAN

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Nine species of *Ascobolus* have been recorded from Taiwan; six by Liou and Chen (1977) and three by Wang (1993, 1996). Recently, an undescribed species of *Ascobolus* was collected from dung of Formosan Reeve's mountjac (*Munticacus reevesi micrurus*) by incubating in a moist chamber (Brummelen 1967). Since this collection appears to differ from all known species, it is described as new.

Ascobolus fushanus Y.Z. Wang et Brummelen, sp. nov. (Figs. 1-3.)

Apothecia dispersa, superficialia, 0.3-1.4 mm lata, 0.3-0.5 mm alta. Receptaculum inito subglobulare, denique expansum, virid, flavo-virens, transceuns brunneolum, furfuraceoum, margine crenulatum. Excipulum textura globulosum. Asci 8-spori, cylindrio-lavati, 178-208 x 12.5-16 μm, membranis mixtura singularis in statu juvenili Melzeri coerulescentibus. Ascosporae uniseriatae, maturitis biseriatae; anguste ellipsoideae, (14-)15-17.2(-18) x (6.5-)7-8 μm, violaceae, transceuns violaceo-brunneolae, cristis longititudinalibus raro anastomosantibus ornatae;1-1.3 μm latis. Paraphyses simplices vel ramosae, cylindricae, apice irregulari et subamplificati,3-5 μm lati; in flavo-virens mucum inclusum.

Apothecia scattered, superficial, with a short stalk, 0.3-1.4 mm broad, 0.3-0.5 mm high. Receptacle at first subglobular and closed, then opening and expanding, green to yellowish green, becoming brownish, furfuraceous, with crenulate margins. Disc yellowish green to brownish, dotted with purplish brown tips of mature asci. Ectal excipulum of a *textura globulosa*, cells 12.5-37 μm broad, layer 37-60 μm thick. Medullary excipulum of varying thickness, cells hyaline, 15-50 μm broad. Subhymenial layer 25-50 μm thick, of small globose cells, 5-7.5 μm broad. Asci 8-spored, cylindric-clavate, rounded above, tapering below, 178-208 x 12.5-16 μm; the walls are very pale blue in Melzer's reagent only when young. Ascospores uniseriate, at maturity biseriate; narrowly ellipsoid, (14-)15-17.2(-18) x (6.5-)7-8 μm, length/breadth ratio 2.01-2.36; first hyaline, then purplish becoming purplish brown, ornamented with longitudinal, rarely anastomosing ridges; 1-1.3 μm broad; each with an unilateral gelatinous sheath when freshly released. Paraphyses simple or branched, cylindrical, 2-3 μm at the base; tips irregularly shaped and slightly enlarged, 3-5 μm broad; embedded in yellowish-green mucus.

Etymology: Latinized from Fushan Botanical Garden; locality of the dung collection.

Holotype: Taiwan. Ilan: Fushan Botanical Garden, on dung of Formosan Reeve's mountjac (*Munticacus reevesi micrurus*), Oct. 29, 1996, Y.Z. Wang 9646 (National Museum of Natural Science, TNM).

Specimens examined: Holotype, same locality; Feb. 3, 1997, Y.Z. Wang 9703 (National Museum of Natural Science, TNM).

This species is characterized by the narrowly ellipsoid ascospores and the pattern of spore ornamentation. It is related with the group of *A. crenulatus, A. minutus, A. michaudii*, and *A. cervinus*. *Ascobolus michaudii* has larger (17-22 x 9.5-12 μm) ascospores, and the ascal walls clearly turning blue in Melzer's reagent. The ascospores of *A. crenulatus, A. minutus*, and *A. cevinus* are ornamented with closely spaced longitudinal striae (Brummelen 1967). *Ascobolus hansenii* (Paulsen & Dissing 1979, Brummelen 1980) also has broad ridges on the spore surface; but the apothecia are yellowish and ascospores are fusoid.

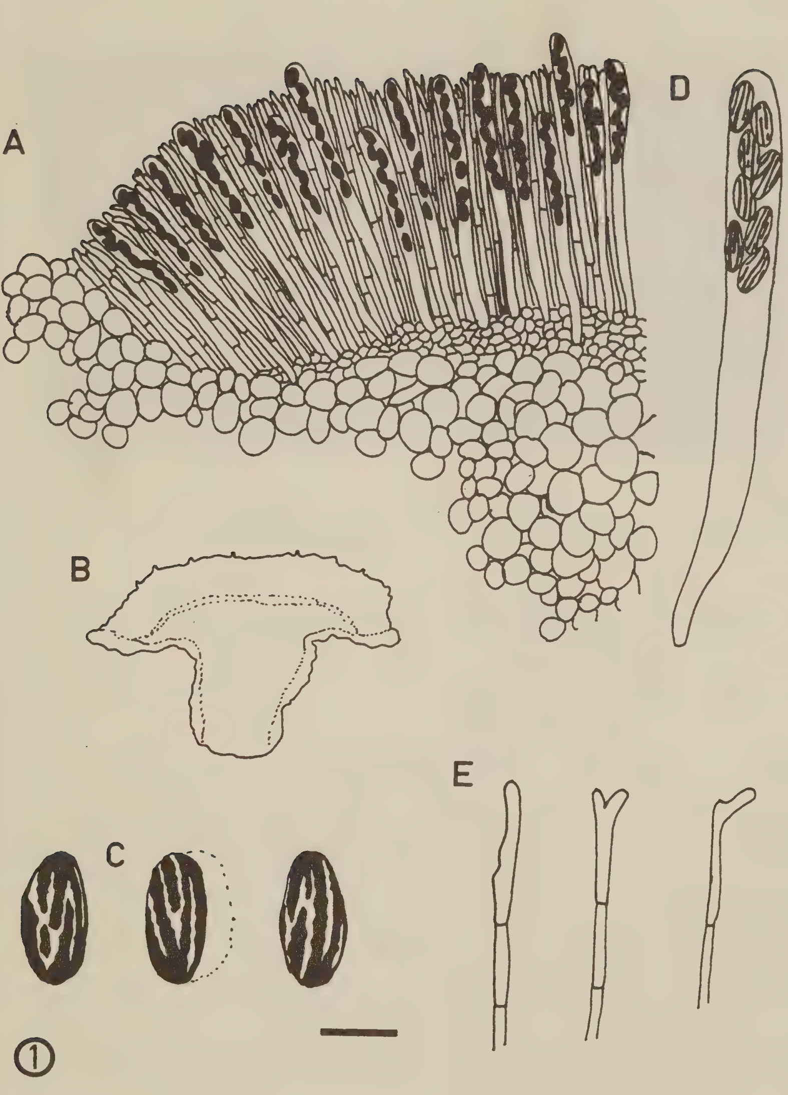
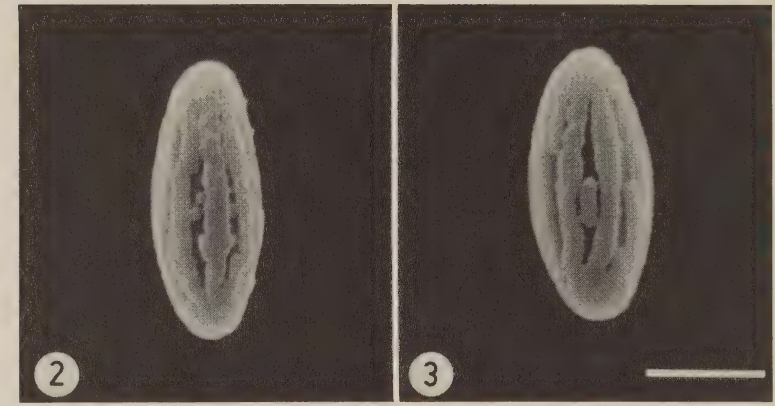


Fig. 1. *Ascobolus fushanus* A. Cross section of the apothecial margin. B. An apothecium. C. Three ascospores. D. An ascus. E. Tips of paraphyses. Bar = 50 μm for A, 400 μm for B, 10 μm for C and E, 25 μm for D.



Figs 2,3. Ascospores of *Ascobolus fushanus* (SEM). Bar = 10 μm.

ACKNOWLEDGMENT

We thank Dr. James W. Kimbrough for reviewing the manuscript and Mr. W.-N. Chou for preparing the Latin diagnosis.

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PEZIZA URINOPHILA, A NEW AMMONOPHILIC DISCOMYCETE

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In a series of experiments relating to application of urea to forest soils conducted by the second author in Japan, a number of fungal species were repeatedly collected (Sagara 1975). Among these, one operculate discomycete was suggested as a new species of *Gelatinodiscus* (Sagara 1975). Later, it was tentatively renamed as *Peziza korfii* (Sagara 1992), because *Gelatinodiscus* was found to be inoperculate (Carpenter 1976). But the name has never been validly published. In 1994, a series of similar experiments in collaboration with Dr. T. Fukiharu at Natural History Museum and Institute, Chiba, Japan were undertaken in the forests of Taiwan. An unknown discomycete was collected from one of the experimental plots. A part of the specimen was sent to the second author for verification. It was identified as identical to that discomycete collected in Japan. Information on these specimens were put together. It is renamed as *Peziza urinophila* and described as a new species.

Peziza urinophila Y.-Z. Wang et Sagara spec. nov.

Apothecia discoidea, flavovirens vel olivaceobrunnea, 4-12 mm lata, subsessilia vel stipitata; stipes 0-6 mm alta, extra furfuraceus. Receptaculi brunnea, subtiliter furfuracea. Margo subelevata, denticulata. Ecto-excipulum textura globulosa, cellulae 12.5-37.5 μm lata. Excipulum medullosum textura angularie-globulosa. Subhymenium tenuie, parva cellulae vel hypha 5-12.5 μm lata. Hymenium flavo brunnea, 150-200 μm. Asci octospori, J+, toto pariete iodo caerulescens, cylindracei, 155-200 x 8.5-12.5 μm. Ascosporae uniseriatae, oblongae-ellipsoideae, (12.5-)14-18(-20) x 6-8(-9) μm, hyalinae, subflava, longitudinalie costatae. Paraphyses simplices vel ramosa, septatae, apices uncinatae, 5-6 μm lata.

Holotypus: Taiwan, Nantou: Lienhuachih, on litter of *Pasania* forest after urea application, Oct. 17, 1994, coll. W.N. Chou (National Museum of Natural Science, TNM F2606).

Etymology: from Latin, urine + loving.

Apothecia discoid, yellow, yellowish green to olive brown, 4-12 mm in diam., subsessile or with a short stalk, 0-6 mm high, stalk surface scurfy, base covered with white mycelium, receptacle brown, furfuraceous with groups of brown-walled globose cells 20-35 μm in diam. Margin slightly raised, dentate. Ectal excipulum of a *textura globulosa*, cell walls pale brown, 12.5-37.5 μm in diam, with a few septate filamentous hairs, layer 50-100 μm thick. Medullary excipulum of a *textura angularis-globulosa*, consisting of large, thin-walled cells, up to 100 μm in diam., layer 50-300 μm thick. Subhymenium thin, with small cells and hyphae, 5-12.5 μm wide, layer 80-100 μm thick. Hymenium yellowish brown, 150-200 μm thick. Asci eight-spored, arising from repeating croziers, cylindrical, tapering below, 155-200 x 8.5-12.5 μm, whole ascal wall turning blue in Melzer's reagent. Ascospores uniseriate, oblong-ellipsoid, (12.5-)14-18(-20) x 6-8(-9) μm, hyaline to pale yellow, ornamented with irregular longitudinal ridges 1-1.6 μm wide. Paraphyses simple or branched at the base, septate, 2-3 μm wide, tips uncinate and enlarged to 5-6 μm wide.

Habitat: On forest litter after urea application or after decomposition of animal matter.

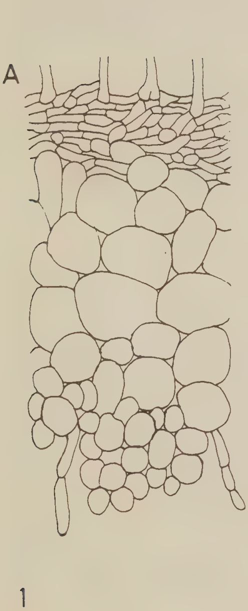
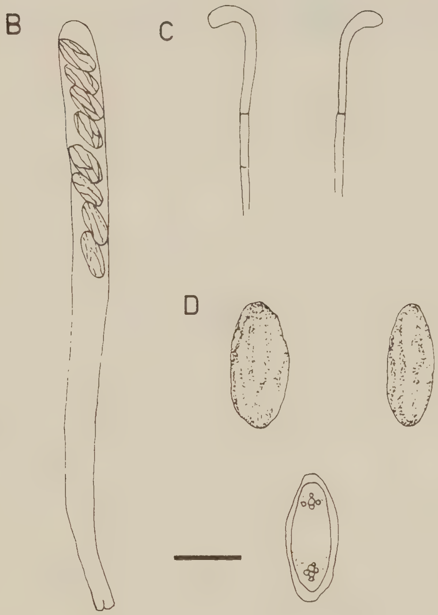
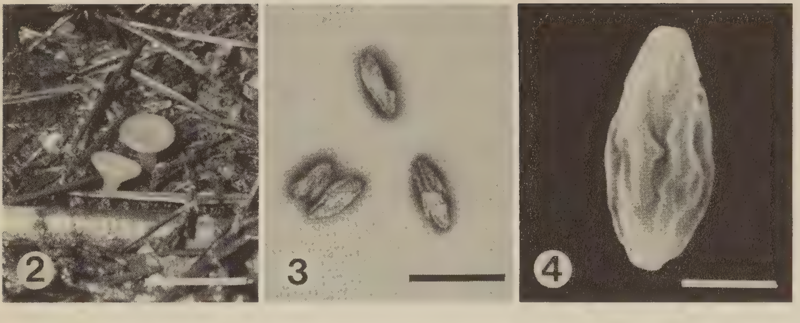



Fig. 1. *Peziza urinophila* (Holotype). A. Excipular structures. B. An ascus. C. Paraphyses tips. D. Ascospores. Scale bar = 50 μm for A, 35 μm for B, 25 μm for C, and 10 μm for D.

Specimens examined: TAIWAN, holotype. JAPAN, Kyoto Pref.: on litter of *Pinus densiflora-Chamaecyparis obtusa* forest (abbreviated as *P-C* forest below) after urea application in the laboratory, Dec. 23, 1965 (SAG 0-2)(SAG: personal herbarium of

N. Sagara); on *P-C* forest soil after urea application in the laboratory, Jan. 4, 1966 (SAG 0-1); on *P-C* forest ground after deposition of human urine, July 10, 1967 (SAG 489); on *Cryptomeria japonica* forest ground after decomposition of a human body (by suicide), Sep. 13, 1968 (SAG 1343); on *P-C* forest litter after urea application in the laboratory, Mar.24, 1969 (SAG 1500); on *P-C* forest ground after ammonium acetate application, May 14, 1969 (SAG 1526); on *P-C* forest ground after urea application, Sep. 4, 1969 (SAG 1666); on *P-C* forest ground after urea application, Sep. 4, 1969 (SAG 1667); on *Castanopsis cuspidata* forest ground after decomposition of a dog body, Sep. 20, 1972, coll. Minoru Hamada (SAG 1832); on *P-C* forest ground after application of ammonium sulfate and sodium hydroxide, June 9, 1972 (SAG 2271); on *P-C* forest ground after polypeptone application, Sep. 8, 1972 (SAG 2351); on *P-C* forest ground after mackerel (sea-fish) application, Sep. 8, 1972 (SAG 2357); on *P-C* forest ground after formamide application, Sep. 10, 1972 (SAG 2368); on *P-C* forest ground after ammonium formate application, Sep. 10, 1972 (SAG 2370); on *P-C* forest ground after potassium acetate application, Sep. 10, 1972 (SAG 2371); on *P-C* forest ground after ammonium acetate application, Sep. 10, 1972 (SAG 2372); on *P-C* forest ground after urea application, Aug. 6, 1987 (SAG 3791). Oita Pref.: on *Pinus densiflora* forest ground after urea application, Sep. 5, 1968 (SAG 1326); on *Fagus crenata* forest ground after urea application, Sep. 5, 1968 (SAG 1337). Toyama Pref.: on *Abies mariesii* forest ground after urea application, Sep. 27, 1968 (SAG 1362).

This species is characterized by the spore shape and ornamentation. *Peziza quelepidotia* Korf & O'Donnell and *P. natrophila* Khan also have yellow-green stipitate apothecia, the former growing on *Sphagnum* (Korf 1973) and the latter being found on plots treated with sodium carbonate and potassium carbonate (Khan 1976), but both species have verrucose ascospores. Stipitate apothecia are not uncommon in the genus *Peziza*. Häffner (1992, 1993) examined the sterigmated form of five *Peziza* species and concluded that those forms are modifications of distinct species.



Figs. 2-4. *Peziza urinophila*. 2. Two apothecia. 3.Ascospores. 4. An ascospore (SEM). Scale bars = 20 mm for Fig. 2, 20 μm for Fig. 3, 5 μm for Fig. 4.

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PSEUDOSTRACODERMA, A NEW GENUS OF HYPHOMYCETES FROM TIERRA DEL FUEGO, ARGENTINA

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ABSTRACT

Pseudostracoderma terricola sp. nov., type of a new genus *Pseudostracoderma* is described from soil from Tierra del Fuego, Argentina.

It is characterized by smooth conidia, monoblastic conidiogenus cell, irregular repeatedly branched conidiophores and conidial cells forming a complex head.

The generic characters are compared with the similar genus *Ostracoderma* Fries (1825).

Key words: *Pseudostracoderma*, soil fungi, Tierra del Fuego, Argentina.

INTRODUCTION

During a survey of Hyphomycetes from Tierra del Fuego as a part of the Flora Criptogámica de Tierra del Fuego, *Pseudostracoderma*, an undescribed fungus belonging to the Hyphomycetes was found in soil of a *Nothofagus pumilio* forest, near a sulfur spring, which is herein described as a new genus and species.

MATERIAL AND METHODS

Pseudostracoderma terricola was isolated from soil by washing techniques (Parkinson & Williams, 1961; Williams, Parkinson & Burges, 1965) and each particle was planted in CMC (Carboxymethylcellulose, Hercules 7H3 SF).

Specimens for scanning electron microscopy (SEM) were cut from a pure culture growing on mycological agar, in Petri dishes, fixed in glutaraldehyde 4% v/v in water during 4 hours, and then washed 3 times during 15 min. with phosphate buffer. Dehydration was performed in a graded acetone - water 25%, 50%, 70%, 95% and 100% v/v series, air dried, after which the material was mounted, coated with gold and then observed with a Phillips PSEM 500 scanning electron microscope.

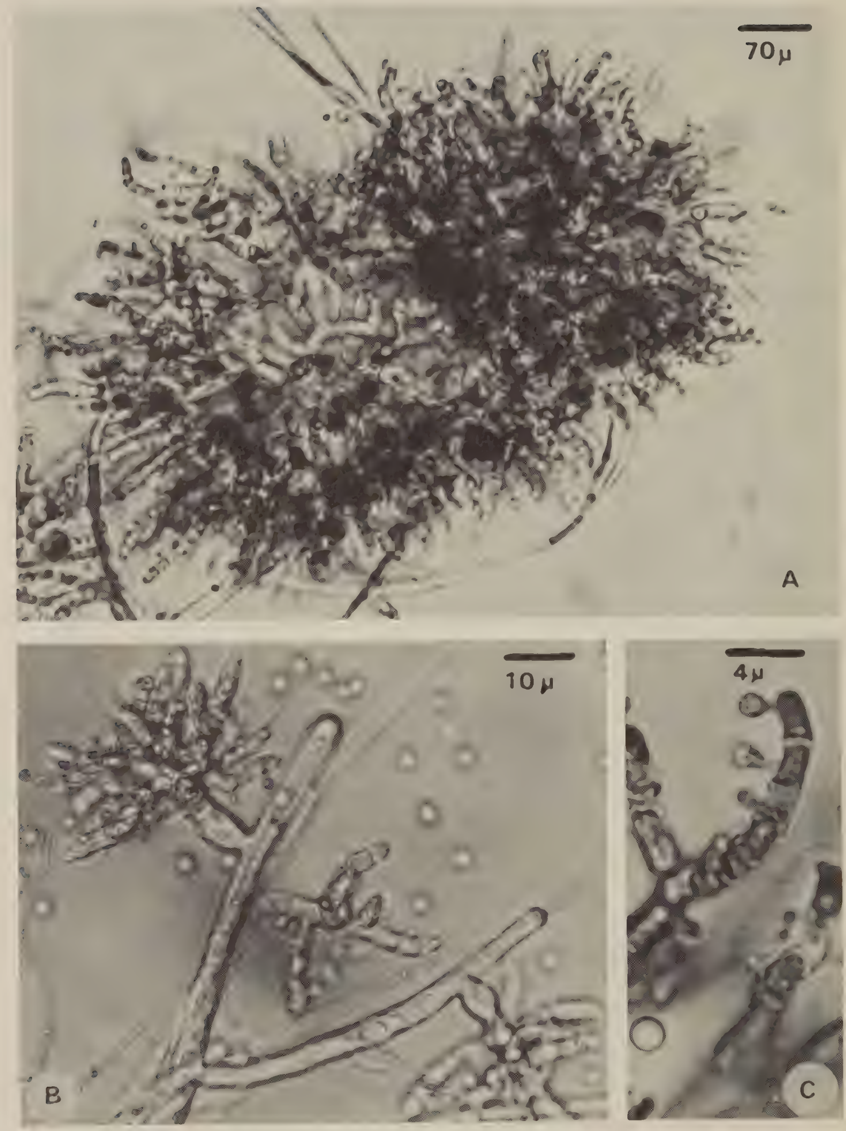

Fig.1: A. Morphology of the conidiophore ramification. B. Conidiophores arising from a mycelium. C. Conidiogenus cells with conidia.

TAXONOMIC PART

Pseudostracoderma Martinez et Godeas anam. gen. nov.
Etym.: Pseudo = false + *Ostracoderma*.

Coloniae effusae, primo hyaline, demum ochraceae. Mycelium superficialibus. Conidiophoris macronematosis, mononematosis, solitariis, septatis, ramificatis, capitulis complexis efformantibus, hyalinis vel ochraceis, laevis. Cellulis conidiiferis monoblasticis, integratis, cylindricis, terminalis vel clavatis, asymetricis, septatis, hyalinis. Locus conidiogenis in cellulis diversis, numerosis gemmis laxe disseminatis simultaneis in pedicellis curtis perspicuis, collapsantes in maturitate. Conidiis holoblasticis, solitariis, acropleurogenis simplices, siccis, non septatis, laevis.

Species Typica: *Pseudostracoderma terricola* Martinez et Godeas anam. sp. nov.

Colony effuse at first hyaline ochraceous with age. **Mycelium** superficial. **Conidiophores** macronematous, mononematous, solitary, septate, branching repeatedly and forming complex heads, hyaline to pale ochraceous, smooth. **Conidiogenous cells** monoblastic, integrated terminal cylindrical to clavate, asymmetrical septate, hyaline. **Locus conidiogenous** along several cells, conspicuous, short pedicells collapsing almost entirely at conidium maturity. **Conidia** holoblastic solitary, acropleurogenous, simple, dry, non septate, smooth.

Species Typica: *Pseudostracoderma terricola* Martinez et Godeas anam. sp. nov.

Pseudostracoderma terricola Martinez et Godeas sp. nov.
Etym.: L. terricola, from soil.

Coloniae effusae, primo hyaline, demum ochraceae. Mycelium superficialibus. Conidiophoris macronematosis, mononematosis, 25-30 x 4,5 μm solitariis, septatis, ramificatis, capitulis complexis efformantibus, hyalinis vel ochraceis, laevis. Cellulis conidiiferis monoblasticis, integratis, cylindricis, terminalis vel clavatis, 17,5-30 x 35 μm asymetricis, septatis, hyalinis. Locus conidiogenis in cellulis diversis, numerosis gemmis laxe disseminatis simultaneis in pedicellis curtis perspicuis, collapsantes in maturitate. Conidiis holoblasticis, solitariis, acropleurogenis simplices, siccis, hyalinis, in aggregatis coloratis, sphericis, non septatis, laevis 3-4x2,5-3,5 μm .

Teleomorphosis ignota

Colony effuse at first hyaline ochraceous with age. **Mycelium** superficial. **Conidiophores** macronematous, mononematous, solitary, septate,

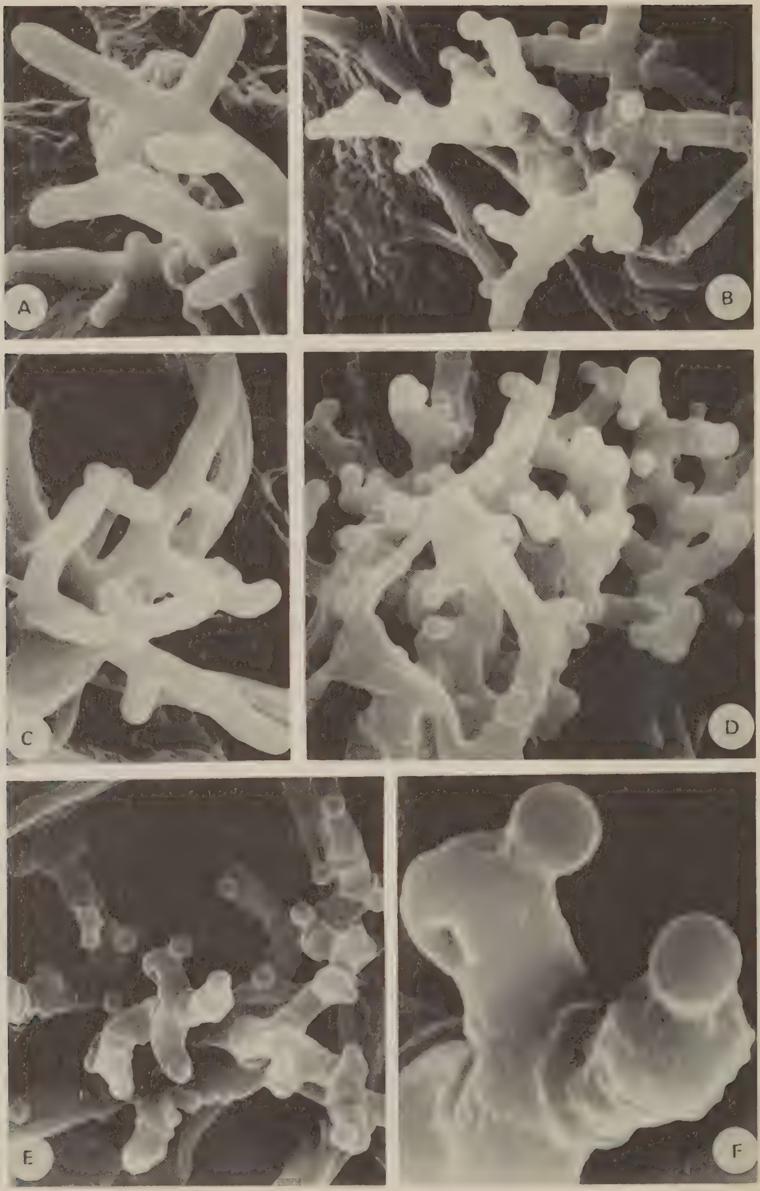

Fig.2: A. Conidiophore ramification details. SEM 3200 x. B, D, and E. Conidiophores with conidia, details. SEM 12500 x.

branching repeatedly and forming complex heads (Fig. 2 A and C), hyaline to pale ochraceous, smooth (Fig 1A and B). **Conidiogenous cells** monoblastic, integrated terminal cylindrical to clavate, 17,5-30 x 35 µm asymmetrical septate, hyaline. **Locus conidiogenous** along several cells, conspicuous, short pedicells collapsing almost entirely at conidium maturity (Fig. 1C and Fig. 2B, D, E, F). **Conidia** holoblastic, solitary, acropleurogenous, simple, dry, individually hyaline, coloured in mass, spherical, non septate, smooth 3-4x2,5-3,5 µm.

Holotype: saprophytic in soil. Termas de Río Valdez, Tierra del Fuego, Argentina. In Herb. BAFC N° 33255 and in culture collection BAFC cult. N° 2315.

Isotype: Deposited in Instituto Spegazzini (LPS) culture collection.

DISCUSSION

Hennebert (1973) made a critical revision of *Botrytis*-like genera leading to the recognition of *Ostracoderma* Fries, Botrytis Pers., *Chromelosporium* Corda, *Glischroderma* Fuckel and six new genera: *Pulchromyces* Hennebert, *Phymatotrichopsis* Hennebert, *Streptobotrys* Hennebert, *Amphobotrys* Hennebert, *Verrucobotrys* Hennebert and *Dichobotrys* Hennebert. He also presented a synoptic key and systematic chart based on the generic characters such as: arrangement, branching of conidiophores, conidial shape and wall ornamentation.

Those fungi including *Botrytis* produce solitary holoblastic conidia on pedicel, conidiogenous cells at the end of conidiophore branches.

Our isolate, observed under SEM shows smooth conidiophores and conidia as observed under light microscopy. Conidiogenous cells are monoblastic and seem to indicate the production of only one spore on a short pedicel.

The genus *Pseudostracoderma* resembles *Ostracoderma* Fries in the spores. When the branching of conidiophores and conidiogenous cells are considered they differ. *Pseudostracoderma* has conidiophores macronematous branching repeatedly towards the apex and monoblastic conidiogenous cells and *Ostracoderma* has conidiophores dichotomously toward the apex and polyblastic conidiogenous cells.

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LEAF SCORCH OF PURPLE NUTSEDGE (*CYPERUS ROTUNDUS*) CAUSED BY *ASCOCHYTA CYPERIPHTHORA* SP. NOV.

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ABSTRACT

A new damaging foliar disease of the world's worst weed, purple nutsedge (*Cyperus rotundus*), was found in the Brazilian states of Minas Gerais and Rio de Janeiro. Isolates of a previously undescribed species of *Ascochyta* were obtained from plants of *C. rotundus* showing symptoms of leaf scorch. The name *Ascochyta cyperiphthora* is proposed for this new fungal pathogen of purple nutsedge. Inoculation of healthy plants of purple nutsedge with a conidial suspension of *A. cyperyphthora* (1.8×10^6 spores/ml) resulted in general necrosis of aerial parts within 3 days. *A. cyperiphthora* was reisolated from diseased tissues.

INTRODUCTION

Purple nutsedge (*Cyperus rotundus* L.) is regarded as the word's worst weed (Holm & Herberger, 1969; William, 1976) and the worst weed in Brazilian agriculture (Lorenzi, 1982; Kissmann, 1991). The pathogenic mycobiota associated with *C. rotundus* has been recently explored for potential biocontrol agents (Barreto & Evans, 1995; Pomella & Barreto, 1995; Mello *et al.*, 1996; Kadir & Charudattan, 1996; Pomella *et al.*, 1996; Upadhyay *et al.*, 1991). As a result of these investigations, the following fungal pathogens have been selected for further studies in order to acsess

SEE ERRATA

their bicontrol potential: *Ascochyta cypericola* R. K. Upadhyay, *Cercospora caricis* Oudemans, *Dactylaria higginsii* (Luttrell) M. B. Ellis, *Duosporium yamadanum* (Matsuura) Tsuda & Ueyama and *Puccinia canaliculata* (Schweinitz) Lagerheim.

An intensive survey of the pathogenic mycobiota of *C. rotundus* was initiated in 1988 (Barreto & Evans, 1995a) in the Brazilian state of Rio de Janeiro. Five fungal pathogens were found during twelve months of intensive surveying. Subsequent *ad hoc* collections revealed the occurrence of an aditional, previously unrecorded disease in two localities in the state of Rio de Janeiro and one in the state of Minas Gerais. In the field, the disease starts as necrotic spots that develop into a leaf scorch typically leading to necrotic girdling of leaf blades. However, evidence of the pathogen is difficult to detect even when fresh diseased material is examined under the binocular. This scarcity of fungal strutures may explain why the pathogen was not recorded during the initial surveys. The present paper describes the pathogen involved and the tests conducted to prove Koch's postulates.

MATERIAL AND METHODS

Isolation and characterization

Several 1 cm fragments of leaves from the two sites in Rio that showed necrosis were washed and surface sterilized by dipping into a 2 % solution of sodium hypochlorite for periods of 3, 6, 9, 12 and 15 min. Excess sterilizing solution was removed by rinsing in sterile distilled water and the fragments were then transferred to petri dishes containing V8 juice-agar medium. After two days incubation at 25 °C, cotton-like mycelium of homogeneous appearance emerged from most of the leaf fragments. The plates were then transferred to an incubator at the same temperature, with a light regime of 12 h darkness and 12 h of near UV light. Pycnidia were observed in the agar as well as in the leaf samples after one week of incubation. The morphology of the fungal structures obtained in culture was studied using a Leica light microscope fitted with a Leica camera for microphotography.

Pathogenicity test

Tubers of healthy purple nutsedge plants were taken from a population established from homogeneous asexually produced material originally obtained from a single locality in the municipality of Carmo, in the state of Rio de Janeiro. These were washed and planted individually in pots containing a manured, methyl bromide-sterilized soil. Healthy, young 4-5 leaved plants (around 20 days after emergence) were used for the pathogenicity test. These were divided in to four treatments: control unwounded, control wounded, wounded inoculated and unwounded inoculated, consisting of four plants each. Wounded plants had their adaxial leaf surfaces scratched with a needle. Petri plates containing V8-juice agar medium were inoculated centrally with mycelial discs obtained from the periphery of actively growing colonies of the fungus. Pycnidia were scraped from 2-weeks-old cultures, suspended in sterile destilled water and broken open using a Politron homogenizer (4 min/5 speed). The resulted conidial suspension was calibrated to give a concentration of 1.8×10^6 spores/ml, using a hemacytometer. This suspension was spread over the abaxial and adaxial leaf surfaces of the purple nutsedge plants with the aid of a fine paint-brush. Control plants were painted with sterile distilled water only. The plants were immediately transfered to a dew chamber (*ca.* 100 % relative humidity) where they were left for 48 h. and then removed to a greenhouse where disease development was monitored daily.

RESULTS AND DISCUSSION

Characterization

The morphology of the pycnidial fungus associated with the diseased purple nutsedge plants was recognized as typical of the genus *Ascochyta* and found to be distinct from other species of this genus recorded on members of the Cyperaceae. This is hereby considered to represent a new species for which the following name and description are given.

Ascochyta cyperiphthora A. W. V. Pomella & R. W. Barreto sp. nov.
Etym: destroyer of *Cyperus.*
Laesiones brunae vel latericiae, circulares vel irregulares. *Conidiomata* pycnidialia, immersa vel erumpentia, globularis, (textura angularis), 90-130µm, paris pycnidialis pseudoparenchymaticus, ex 6-9 stratis cellularum; strato estimo bruneo, stratis interioribus hyalinis vel pallide stramineo. *Ostiola* fere circularia, 12-25µm diam. *Cellulae conidiogenae* hyalinae, laevis, lageniformes vel ampulliformes, phialidicae, 4-7 x 3-7µm. *Conidia* hyalina, cylindrica, apice rotundata, 10-15,5 x 3-5µm, 1-2 septata, guttulata.

Holotypus. Brazil: Rio de Janeiro, Nova Friburgo, in foliis vivis *Cyperus rotundus*, R.W. Barreto, 20 Febr. 1996. Herbário do Departamento de Micologia da UFPE, URM 75809. *Isotypus*. Herbário do Departamento de Micologia da UNB, UB 13.533.

Lesions limited to leaves and bracts initially clorotic and later becoming depressed and necrotic, 2-4 mm wide, initially circular with a darker centre, coalescing and elongating later, often girdling the leaf blades and leading to leaf death. *Internal mycelium* branched, hyaline to pale yellow, 1-2μm diam., septate. *External mycelium* absent. *Conidiomata* pycnidial, amphigenous, immersed, solitary, globose, 90-130 μm diam (Fig. 1A); wall pseudoparenchymatous, composed of a hyaline to pale yellow inner layer, 3-5 cells thick, and a 3-4 cells thick dark brown outer layer (Fig. 2A). *Dehiscence* single, central, ostiolate, circular, 12- 25 μm diam. *Conidiogenous cells* hyaline, discrete, enteroblastic with periclinal thickening, lageniform to ampulliform, 4-7 x 3-7 μm, smooth (Fig. 2B). *Conidia* slimy, cylindrical, 10-15.5 x 3-5 μm, tapering towards the base, apex and base rounded, 1-2 septate (mostly supramedianly 1-septate), not constricted, guttulate, hyaline, smooth (Fig. 1B).

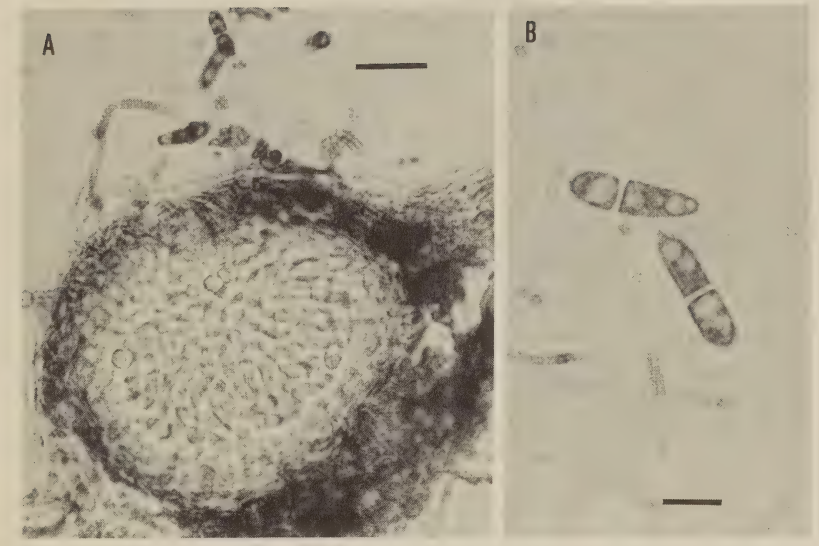

Fig. 1- *Ascochyta cyperiphthora.* A, Vertical section of pycnidial conidioma (Bar= 20μm); B, Conidia (Bar= 5μm).

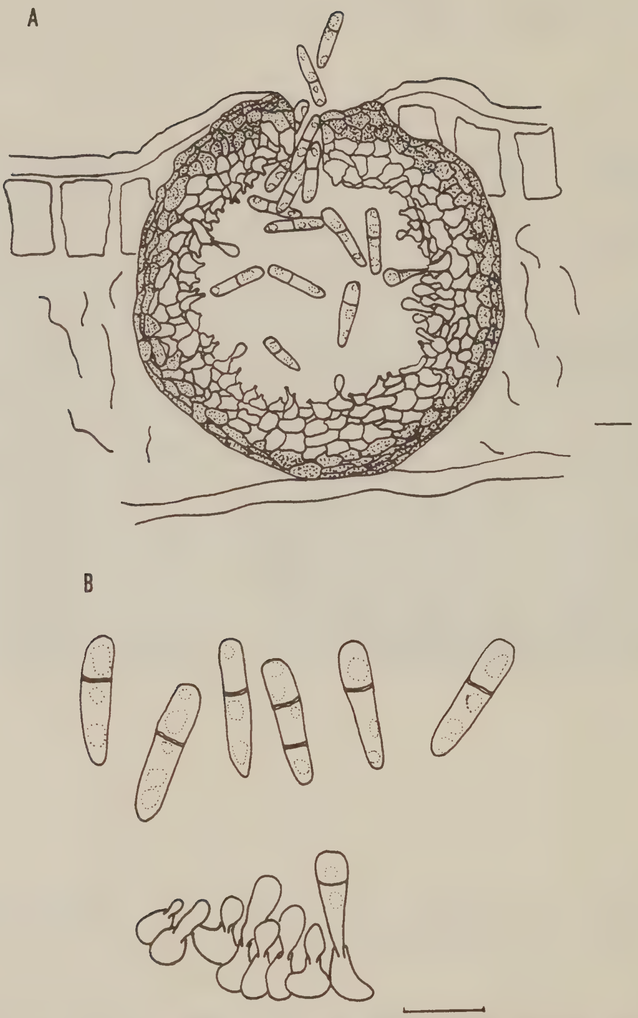

Fig. 2. *Ascochyta cyperiphthora*. A, Vertical section of pycnidial conidioma, note the wall composed by two layers; B, Conidiogenous cells and conidia (Bars A & B= 10μm) .

In culture. Colonies relatively fast-growing, 9 cm after 13 days at 25 °C, woolly, grey centrally with a white periphery; imersed pycnidia abundantly produced; sporulation abundant (but absent when growth is over 35 °C).

Three species of *Ascochyta* are known from the literature to have *C. rotundus* as a host: *Ascochyta cypericola* R. K. Upadhyay (Upadhyay et al., 1991) , *Ascochyta cyperi-ochracei* Punithalingam (Punithalingam, 1988) and *Ascochyta papyricola* Tassi (Litzenberger, 1962). Additionally five other species have been recorded from other members of the Cyperaceae: *Ascochyta caricis-arenariae* Melnik., *Ascochyta caricis-hebridensis* Punithalingam, *Ascochyta caricis-ripariae* Punithalingam, *Ascochyta kurdistanica* Bubák. and *Ascochyta tokyensis* (Tassi) Punithalingam (Punithalingan, 1988). All of these are morphologically distinct from the fungus found in Brazil. Differences between *A. cyperiphthora* and other species associated with *C. rotundus* are given in Table 1. The most relevant distinguishing characters between the new species and the other two taxa recorded on *C. rotundus* are the following: *A. cyperiphthora* differs from *A. cyperi-ochracei* and *A. papyricola* in having significantly larger conidia with a different shape and a predominantly supra-medianly septate condition. It differs from *A. cypericola* in its smaller conidia and the absence of a septal constriction. In adition, septation pattern, number of septa and guttulation are other characters that contribute to the separation of *A. cyperiphthora* from the above mentioned species.

Pathogenicity test

Three days after inoculation, all the plants except those in the two control treatments had a general necrosis of the foliage. Samples of necrotic tissue were surface sterilized and plated on tap-water agar; abundant *A. cyperiphthora* pycnidia were produced within 24 hours. No differences were observed between the severity of symptoms on wounded or unwounded plants inoculated with *A. cyperiphthora*, indicating that nutsedge is not predisposed to infection by wounding.

Considering the degree of damage caused to *C. rotundus* by this new fungal pathogen, *A. cyperiphthora* warrants consideration as a potential biocontrol agent for purple nutsedge, together with the other fungi listed by Evans (1987), Barreto & Evans (1995a) and Barreto & Evans (1995b).

Table 1- Morphological characteristics of species of *Ascochyta* associated with *Cyperus rotundus*.

Characters	*A. cypericola* (Upadhyay et al., 1991)	*A. papiricola* (Punithalingam, 1988)	*A. cyperi-ochracei* (Punithalingam, 1988)	*Ascochyta cyperiphthora*
Conidiomata:	pycnidial	pycnidial	pycnidial	pycnidial
Shape	globose	subglobose	subglobose	globose
Position	immersed	immersed	immersed	immersed
Diam.	100-300μm	120-150μm	80-125μm	90-130μm
Conidiogenous cell:				
Shape	doliform to ampulliform	subglobose to doliform	subglobose to ampulliform	lageniform to ampulliform
Size	-	-	-	4-7 x 3-7 μm
Conidia:				
Shape	obclavate, oblong to ellipsoid, constricted	ellipsoid to cylindrical not constricted	cylindrical not constricted	cylindrical to obclavate not constricted
Size	7.5-22x4-6μm (average: 15-18 x 5μm)	7-10x2.5-3μm	8-10x2.5-3μm	10-15.5x3-5μm (average: 12 x 4μm)
Distribution:	India (Upadhyay *et al*, 1991)	Cambodia (Litzenberger, 1962)	Bangladesh (Punithalingam, 1988)	Brazil

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The authors wish to thank Dr. H.C. Evans for his suggestions.

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TAXONOMY OF ROYOPORUS BADIUS COMB. NOV.

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SUMMARY

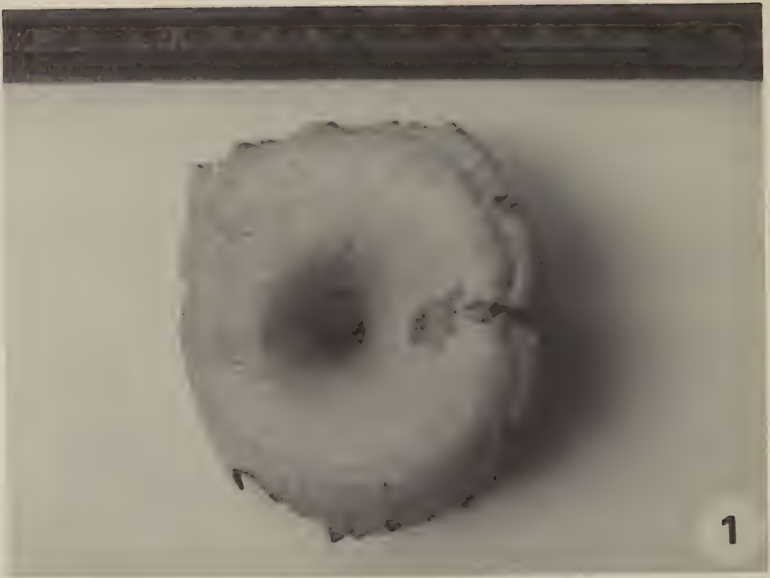
Detailed observations on morphological and anatomical characters of *Polyporus badius* (Pers.) Schwein. are given and in the light of these observations the taxonomy of the fungus is discussed. The new combination *Royoporus badius* (Pers.) De is proposed.

INTRODUCTION

In 1801 Persoon described a fungus which he named *Boletus badius* Pers. (Persoon 1801). Schweinitz (1832) transferred it to the genus *Polyporus* Adans. : Fr. as *Polyporus badius* (Pers.) Schwein. Nunez and Ryvarden (1996) have cited *Polyporus picipes* Fr., *Polyporus dibaphus* Berk. & Curt. and *Favolus trachypus* Berk. & Mont. as synonyms of *P. badius*. In India *P. badius* has been known as *P. picipes* (Bakshi 1971). *Polyporus badius* occurs in Asia, Europe, North America (Nunez and Ryvarden 1996) and Australia (Bakshi 1971). It is a temperate species and in India grows in colder parts like Chakrata, Mussoorie (U.P.) and Kashmir on birch, walnut and Indian oaks (Bakshi 1971), as well as in warmer places like Calcutta (W.B.) (Bakshi 1971). From 1990 to 1995 I collected basidiocarps of *P. badius* from different parts of Calcutta. They grew on stumps amd logs of hardwoods. The present report details studies of the morphological and anatomical characters of *P. badius*, based on the Calcutta collections. The taxonomy of the species is discussed in the light of these findings.

MATERIALS AND METHODS

Observations are based on fresh specimens collected by the author from Calcutta (W.B.), India. Microscopic characters of the basidiocarps are studied from free hand sections mounted in 10% KOH and stained with 1% cotton blue. Voucher specimens are maintained in the Mycological Herbarium of Burdwan Raj College (BRCMH),



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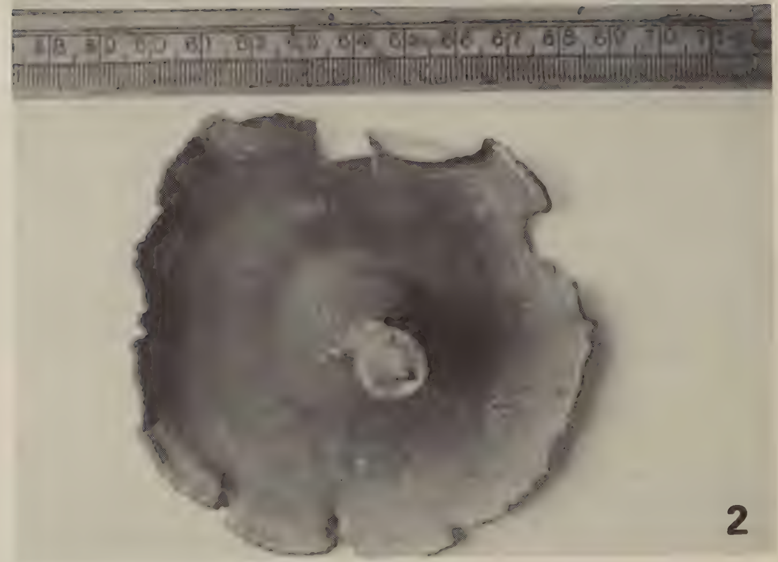

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Burdwan, West Bengal, India. The facultative synonymy follows Nunez and Ryvarden (1996).

DESCRIPTION OF BASIDIOCARP

Royoporus badius (Pers.) De, comb. nov.
= *Boletus badius* Pers., Syn. Meth. Fung. p. 523, 1801 (Basionym)
= *Polyporus badius* (Pers.) Schwein., Trans. Am. Phil. Soc. II, 4 : 155, 1832. = *Polyporus picipes* Fr., Epicris. Syst. Mycol. p. 440, 1836-38. = *Favolus trachypus* Berk. & Mont., Ann. Mag. Nat. Hist. Sci. Nat. III, 11 : 154, 1856. = *Polyporus dibaphus* Berk. & Curt., Grevillea 1 : 32, 1872.

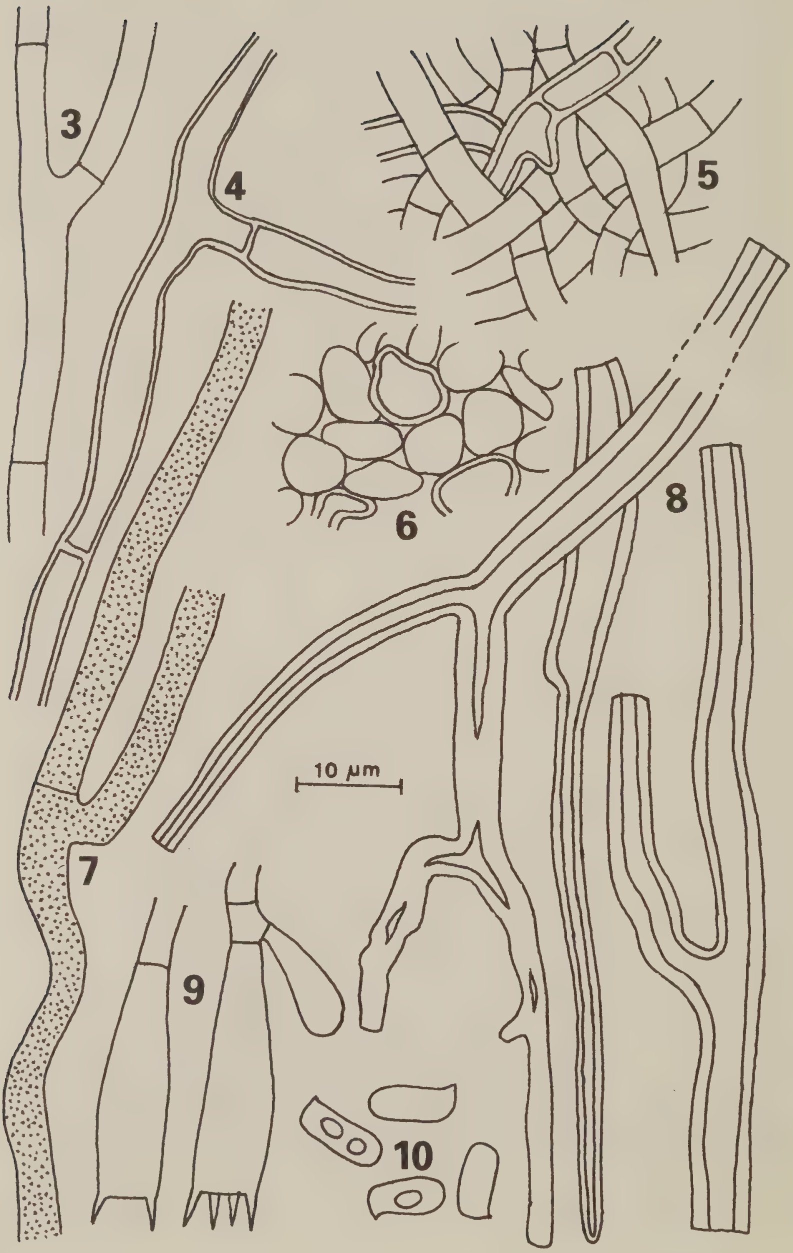
Basidiocarps annual, growing singly or in tufts of 2-4, tough when fresh, hard and corky when dry, laterally, excentrically or centrally stipitate. Stipe solid, up to 6 cm long and 1.5 cm wide, black and minutely tomentose at the base, chestnut brown and glabrous at the apex. Pileus circular, subcircular or flabelliform, sometimes depressed near the stipe, up to 12 cm in diam. and 3-6 mm thick; upper surface (Fig. 1) light chestnut brown to dark blackish brown, often darker in the centre, azonate or with sharp fine radial striations, glabrous, smooth or rugulose on drying; margin wavy, up to 2 mm thick, reflexed; context pale buff, azonate, corky, up to 5 mm thick; hymenial surface (Fig. 2) white to pale buff to brownish, pores circular to angular, 3-6 per mm, tube layer white when young becoming slightly darker than the context, up to 1 mm long, decurrent on the stipe.

Hyphal system dimitic. Generative hyphae simple setate, usually hyaline and thin-walled, infrequently branched, 2.2-5.6 µm wide (Fig. 3), some slightly thick-walled and a little inflated (Fig. 4), on the pileus surface and stipe surface some closely interlaced forming skin-like structure (Fig. 5); in the central depression on the pileus surface occur thin to slightly thick-walled pale brown mass of cuticular cells, more evident in fresh specimens (Fig. 6). Gloeoplerous hyphae (Fig. 7) 4-5 µm wide. Binding hyphae dendritic, rarely branched, thick-walled to solid, usually 3-6 µm wide with tapering ends up to 2 µm (Fig. 8). Basidia hyaline, clavate, with 2 and 4 sterigmata, 20-30 x 5.6-7.0 µm, simple septate at the base (Fig. 9). Basidiospores hyaline, thin-walled, smooth, cylindric, apiculate, non-amyloid, 6-8 x 3-4 µm, some with one or two guttulae (Fig. 10). Hyphal pegs present.

ROT: White rot.

SPECIMENS EXAMINED : All from Calcutta, W.B., India. BRCMH R 901, Royal Botanic Garden, on dead branch of *Alnus nepalensis* D. Don., 23.10.1990; BRCMH R 921, Tala Park, on angiosperm stump, 17.9.92; BRCMH R 931, Lake Town, on stump of *Eucalyptus globosus* Labil., 12.10.93; BRCMH R 951, Behala, on dead wood of *Salix tetrasperma* Roxb., 16.10.95.

Figs. 1& 2. *Royoporus badius* (Pers.) De : 1. upper surface of basidiocarp; 2. hymenial surface of basidiocarp.


10 µm

DISCUSSION

Polyporus badius has been included in the genera *Boletus* Fr., *Favolus* Fr. and *Polyporus* Adans. : Fr. by different workers.

The genus *Boletus* is characterised by - (i) coloured, olive to brown basidiospores (ii) soft, fleshy, readily decaying basidiocarp and (iii) the tube layers of pores are easily separable from the context (Alexopoulos and Mims 1979, Smith and Smith 1973). But *Polyporus badius* has basidiospores hyaline, basidiocarp tough (not fleshy or readily decaying) and the tube layer is not separable from context. Differences in such important features rule out including *P. badius* in the genus *Boletus*.

The genus *Favolus* was previously regarded as distinct from the genus *Polyporus* due to lack of clamps in the former and their presence in the latter (Ryvarden and Johansen 1980). But Stankovicova (1973) in a detailed study of the hyphal system of *Favolus brasiliensis* (Fr.) Fr.(= *Favolus tenuiculus* Beauv.), the type species of the genus *Favolus*, described clamps. Due to presence of clamps in the type species of both genera, *Favolus* could not be maintained as a separate genus and Corner (1984) proposed to merge *Favolus* with *Polyporus* s. str. This view was supported by Ryvarden (1990) and Teixeira (1994). Gilbertson and Ryvarden (1987), Roy, De and Pal (1994) and Teixeira (1994) have accepted the transfer of *F. tenuiculus* (=*F. brasiliensis*), the type species of the genus *Favolus*, to the genus *Polyporus* made by Fries (1821). But *P. badius* having simple septate generative hyphae can not be regarded as a member of the genus *Polyporus* or *Favolus*.

My study based on fresh basidiocarps revealed that *P. badius* exhibits a combination of characters that can not be found in any other existing genus excepting *Royoporus* De. Both *Royoporus spathulatus* (Jungh.) De, the type species of the genus *Royoporus* De (De 1996), and *P. badius* possess annual, single to caespitose, stipitate basidiocarps with poroid hymenial surface, a dimitic hyphal system, hyaline, simple-septate generative hyphae, hyaline binding hyphae, hyaline, thin-walled, smooth, cylindrical, non-amyloid basidiospores, and cause white rot of angiospermic wood.

There are some other similarities as well. Although basidiocarps of *P. badius* are generally centrally or excentrally stipitate some are flabelliform, laterally stipitate with depression near the stipe and with sharp fine radial striations like *R. spathulatus*. So many features in common suggest a close relationship between *R. spathulatus* and *p. badius*.

Figs. 3-10. *Royoporus badius*, microscopic structures from basidiocarp. 3. Thin-walled generative hypha. 4. Thick-walled and inflated generative hypha. 5. Closely interlaced nyphae forming skin-like structure on the pileus surface and stipe surface. 6. Cuticular cells at the central depression on the pileus surface. 7. Gloeoplerous hypha. 8. Binding hyphae, 9. Basidia. 10. Basidiospores.

But there are some differences between *R. spathulatus* and *P. badius*. In *P. badius* the stipe is longer and thicker, the pileus is larger and the pores are smaller than *R. spathulatus*. Besides, there are differences in colour of pileus, stipe and context between these two species. But these exomorphological differences may be considered important only at the species level.

Therefore, it is concluded that *P. badius* and *R. spathulatus* are congeneric, and the transfer is proposed : *Royoporus badius* (Pers.) De, **comb. nov.** (Basionym : *Boletus badius* Pers., Syn. Meth. Fung. p. 523, 1801).

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THE LICHEN GENERA CANOMACULINA AND RIMELIELLA (ASCOMYCOTINA, PARMELIACEAE)

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ABSTRACT : The lichen genus *Rimeliella* Kurok. has been relegated into synonymy with *Canomaculina* Elix & Hale. The key characters of *Canomaculina* include the effigurate-maculate upper cortex, ciliate margins, dimorphous rhizines, large, ellipsoidal spores and filiform conidia. A number of new combinations are made and several species are discussed in detail.

Introduction

A detailed study of a range of recent and type collections of the parmelioid genera *Canomaculina* Elix & Hale and *Rimeliella* Kurok., and in particular the type species *Canomaculina pilosa* (Stizenb.) Elix & Hale and *Rimeliella subcaperata* (Kremp.) Kurok., has established that these genera are synonymous. For the most part the distinction of these two genera was a consequence of history rather than a conscious taxonomic decision, as *Canomaculina* was segregated from the heterogeneous genus *Parmelina* Hale (Elix & Hale 1987) whereas *Rimeliella* was segregated from *Parmotrema* sens. lat. (Kurokawa 1991). Indeed, the proximity of *C. pilosa* to some species which at that time were accommodated in *Parmotrema* (but subsequently segregated in *Rimeliella*) has been recognized previously (Krog & Swinscow 1981). Furthermore. the reputed differences in lobe width (narrow in *Canomaculina*; broad in *Rimeliella*) do not survive detailed scutiny. Thus lobe width overlaps significantly (1-15 mm in species formerly included in *Canomaculina*, 5-20 mm in *Rimeliella*), and the colour of the lower surface varies from pale brown to jet black. Thus the expanded genus can be described as follows.

Canomaculina Elix & Hale, *Mycotaxon* **29**: 239 (1987)

= *Rimeliella* Kurok., *Ann. Tsukuba Bot. Gard.* **10**: 1 (1991).

Description: Thallus foliose, loosely adnate to adnate, 5-20 cm wide. Lobes flat, irregular to sublinear-elongate, 1-15 mm wide, subrotund to rotund at apices; ciliate, cilia sparse to dense, simple or often branched, often markedly tapered. Upper surface pale grey to grey, grey-green or pale green (atranorin and chloroatranorin or lichexanthone, ±minor amounts of usnic acid), conspicuously effigurate-maculate, becoming irregularly cracked but without true pseudocyphellae, ±pruinose towards lobe apices, with or without soredia and isidia; upper cortex palisade plectenchymatous with a pored epicortex. Cell walls containing *Cetraria*-type lichenan. Medulla white. Lower surface pale tan to black; rhizines dimorphous, short rhizines extending to the margin or nearly so, simple or rarely branched, 0.05-0.5 mm long, with additional long, coarse, ±grouped rhizines, *ca*. 1-2 mm long. Ascomata apothecial, laminal; disc perforate or imperforate; margin of thalline exciple eciliate. Ascospores broadly ellipsoidal to ellipsoidal, 8 per ascus, 8-20 x 5-12 µm. Conidiomata pycnidial, immersed, usually laminal, punctiform. Conidia filiform, 9-16 x 1 µm.

Key characters of this genus include (see Elix 1993):

- pored epicortex present, pseudocyphellae absent;
- upper cortex effigurate-maculate, grey or yellow-grey, containing atranorin or lichexanthone;
- cell walls containing *Cetraria*-type lichenan;
- apothecia laminal, ± perforate;
- ascospores ellipsoidal, 8-20 x 5-12 µm;
- pycnoconidia filiform, 9-16 x 1 µm;
- thallus with ciliate margins;
- rhizines dimorphous: short, simple rhizines and long, coarse, ± grouped rhizines;
- lower surface commonly paler near margin, darker (black) in centre;
- the presence of medullary fatty acids or orcinol depsidones or β-orcinol depsidones.

New Combinations

A number of new combinations are necessary as a consequence of the above synonymy.

Canomaculina conferenda (Hale) Elix, comb. nov.
Basionym: *Parmotrema conferendum* Hale, *Mycotaxon* **5**: 433 (1977).

Canomaculina cristobalii (L.I. Ferraro & Elix) Elix, comb. nov.
Basionym: *Rimeliella cristobalii* L.I. Ferraro & Elix, *Mycotaxon* **49**: 406 (1993).

Canomaculina erubescens (Stirt.) Elix, comb. nov.
Basionym: *Parmelia erubescens* Stirt., *Scott. Naturalist* **4**: 201 (1877-1878).

Canomaculina fumarprotocetrarica (Marcelli & Hale) Elix, comb. nov.
Basionym: *Parmotrema fumarprotocetraricum* Marcelli & Hale, *Mycotaxon* **25**: 88 (1986).

Canomaculina haitiensis (Hale) Elix, comb. nov.
Basionym: *Parmelia haitiensis* Hale, *Bryologist* **62**: 20 (1959).

Canomaculina kwalensis (Krog & Swinscow) Elix, comb. nov.
Basionym: *Parmelia kwalensis* Krog & Swinscow, *Bull. Br. Mus. nat. Hist.* (Bot.) **9**: 191 (1981).

Canomaculina larensis (López-Fig.) Elix, comb. nov.
Basionym: *Parmotrema larense* López-Fig., *Phytologia* **44**: 89 (1979).

Canomaculina leucosemotheta (Hue) Elix, comb. nov.
Basionym: *Parmelia leucosemotheta* Hue, *Nouv. Arch. Mus. Paris*, ser. 4, **1**: 192 (1899).

Canomaculina neotropica (Kurok.) Elix, comb. nov.
Basionym: *Parmotrema neotropicum* Kurok. in Hale, *Mycotaxon* **5**: 437 (1977).

Canomaculina recipienda (Nyl.) Elix, comb. nov.
Basionym: *Parmelia recipienda* Nyl., *Flora* **68**: 609 (1885).

Canomaculina reitzii (Hale) Elix, comb. nov.
Basionym: *Parmotrema reitzii* Hale, *Mycotaxon* **5**: 439 (1977).

Canomaculina spinibarbis (Kurok.) Elix, comb. nov.
Basionym: *Parmelia spinibarbis* Kurok., *Bull. Nat. Sc. Mus., Tokyo,* **17**: 299 (1974).

Canomaculina subcaperata (Kremp.) Elix, comb. nov.
Basionym: *Parmelia subcaperata* Kremp., *Vidensk. Meddel. Dansk Naturhist. Foren. Kjøbenhavn* **25**: 10 (1874).

Canomaculina subsumpta (Nyl.) Elix, comb. nov.
Basionym: *Parmelia subsumpta* Nyl., *Flora* **52**: 117 (1869).

Canomaculina subtinctoria (Zahlbr.) Elix, comb. nov.
Basionym: *Parmelia subtinctoria* Zahlbr. in H. Handel-Mazzetti, *Symb. Sin.* **3**: 193 (1930).

Canomaculina uruguensis (Kremp.) Elix, comb. nov.
Basionym: *Parmelia uruguensis* Kremp., *Flora* **61**: 461 (1878).

Comments on Particular Species

Canomaculina spinibarbis (Kurok.) Elix

This species was described by Kurokawa in 1974, but has not been mentioned since. This may well be due to the incomplete chemical data recorded at that time. The major constituent of this species is lichexanthone which occurs together with atranorin (minor), chloroatranorin (minor), salazinic acid (submajor) and consalazinic acid (minor).

Canomaculina erubescens (Stirt.) Elix and *C. subcaperata* (Kremp.) Elix

These two taxa were considered conspecific by Hale (1965) and Kurokawa (1991), but were segregated by Krog and Swinscow (1981). I am convinced that two distinct taxa are involved, albeit for rather different reasons than enunciated by the latter authors.

In Australia *C. erubescens* is a corticolous species with a coriaceous thallus and occurs in drier subtropical and tropical woodlands. The lower surface of this taxon is characterized by a broad, brown marginal zone which is densely papillate or covered with short, fine rhizines. The longer, coarse, grouped rhizines occur further within the thallus. *P. erubescens* has short, broadly ellipsoid spores, 10-12 x 8-10 µm, and filiform conidia, 10-14 x 1 µm.

C. subcaperata, on the other hand, is commonly saxicolous or more rarely corticolous, has a membranaceous thallus and occurs in more temperate regions. The lower surface of this species is commonly black to the margins or else it has a very narrow dark brown naked margin, and the fine rhizines are more elongated (0.5-1.0 *cf.* 0.05-0.1 mm long) and dispersed. In *C. subcaperata* the coarse rhizines are solitary (not grouped) and much rarer than in *P. erubescens.* Furthermore, *C. subcaperata* has longer, ellipsoid spores, 12-19 x 6-10 µm, and filiform conidia, 9-14 x 1 µm.

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FURTHER NEW SPECIES IN THE LICHEN FAMILY PARMELIACEAE (ASCOMYCOTINA) FROM AUSTRALASIA

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ABSTRACT : The following new lichen species are described, *Anzia niuginiensis* Elix, *Bulbothrix tuskiformis* Elix and *Hypotrachyna terricola* Elix from Papua New Guinea; *Neofuscelia convexa* Elix, *Xanthoparmelia hypoleiella* Elix, *Xanthoparmelia maccarthyi* Elix and *Xanthoparmelia mayrhoferi* Elix from Australia; and *Neofuscelia malcolmii* Elix from New Zealand.

Introduction

As a result of further study of the lichen family Parmeliaceae in Australasia (Elix 1994, 1995, 1996), I am describing 8 new species. Throughout the present work chemical constituents were identified by thin layer chromatography (Culberson 1972; Culberson *et al.* 1981; Culberson & Johnson 1982; Elix & Ernst-Russell 1993; Elix *et al.* 1988), high performance liquid chromatography (Feige *et al.* 1993; Elix & Ernst-Russell 1996) and comparison with authentic samples.

Anzia niuginiensis Elix, sp. nov. Fig. 1

Species cum thallo ut in *Anzia jamesii* sed ab hac specie thallo parviore, lobis angustioribus et exisidiatis differt.

Type: Papua New Guinea. Morobe Province, Gumi-Slate Creeks Divide, 25 km W of Bulolo, 7°13'S, 146°25'E, 1900 m, on fallen branch in *Castanopsis*-Lauraceae dominated forest on ridge, *H. Streimann 25296,* 19 Oct. 1982; holo: CANB.

Thallus corticolous, loosely adnate, irregularly spreading, 2-4 cm wide. *Lobes* sublinear, separate, dichotomously to subdichotomously branched, 0.4-1.0 mm wide. *Upper surface* off-white to pale grey, flattened, smooth, here and there weakly maculate, ±transversely cracked, lacking lobules, isidia and soredia. *Medulla* white, with a weakly developed chondroid axis of parallel, longitudinally arranged hyphae in middle of the lobes. *Lower surface* with continuous spongiostratum which projects beyond the lobe margins, uniformly attached to lower medullary hyphae or chondroid strand, solid, black, rarely dark brown; rhizines scattered, simple or tufted. *Pycnidia* and *apothecia* not seen.

Chemistry. Cortex K+ pale yellow, medulla K-, C+ red, P-; containing atranorin (trace), chloroatranorin (trace) anziaic acid (major), 4-*O*-methylhypoprotocetraric acid (minor).

Chemically *A. niuginiensis* is identical with *A. jamesii* from New Zealand, the only other species of *Anzia* known to contain a combination of anziaic acid (major) and 4-*O*-methylhypoprotocetraric acid (minor) in the medulla. However, *A. jamesii* differs in having an isidiate upper surface, broader lobes (0.5-2.0 mm *cf.* 0.4-1.0 mm wide), a much more prominent chondroid axis and pruinose lobe tips. Morphologically *A. niuginiensis* resembles the Australian species, *A. minor* Yoshim., and although both species lack isidia, the latter differs from *A. niuginiensis* in having a discontinuous, moniliform spongiostratum on the lower surface and in lacking anziaic acid in the medulla. At present *A. niuginiensis* is only known from the type collection.

Bulbothrix tuskiformis Elix, sp. nov. Fig. 2

Species cum thallo ut in *Bulbothrix suffixa* sed ab hac specie elobulato, ciliis sparsim, ascendentibus, et acido salazinico continente differt.

Type: Papua New Guinea. Southern Highlands. Andawe River, Lama Sawmill logging area, 6 km SE of Ialibu, 6°20'S, 144°01'E, 1840 m, on *Nothofagus* crown in *Nothofagus-Podocarpus* forest, *J. A. Elix 12680 & H. Streimann*, 11.xii.1982; holo: CANB.

Thallus corticolous, adnate, pale mineral grey to grey-green, 1-3 cm wide. *Lobes* linear to sublinear-elongate, di- or trichotomously branched, 0.5-1.2 mm wide, the margin sparsely bulbate-ciliate; bulbate cilia, shiny, ascending, weakly inflated. *Upper surface* plane or slightly convex, smooth, shiny, emaculate, lacking soredia and isidia. *Medulla* white. *Lower surface* pale tan, rhizines dense, highly branched and agglutinated, forming a dense mat, pale tan to dark brown; agglutinated rhizines projecting along the margins of the lobes. *Apothecia* common, short pedicellate, 0.8-1.5 mm wide; disc concave, pale brown; thalline exciple entire, smooth, ecoronate. Ascospores semi-lunate, 9-11 x 2-3.5 µm. *Pycnidia* common, immersed. Conidia bacilliform, 5-6 x 1 µm.

Chemistry. Cortex K+ yellow, medulla K+ yellow then dark red, C-, P+ orange-red; containing atranorin (minor), chloroatranorin (trace), salazinic acid (major), consalazinic acid (minor).

In gross morphology *B. tuskiformis* resembles *B. suffixa* (Stirton) Hale, but the latter species is distinguished by the presence of dense laminal lobules, a black, moderately rhizinate lower surface, and the presence of gyrophoric acid in the medulla. *B. tuskiformis* is characterized by the pale tan lower surface and the densely branched, bushy, and in part agglutinated rhizines that form a woolly mat *ca.* 1 mm thick and project beyond the margin of the lobes. This branching pattern of the rhizines is more common in the genus *Relicina* (e.g. in *Relicina acrobotrys* Hale), but this is the first example of it occurring in *Bulbothrix*. The marginal bulbate cilia are also quite unusual in this species, as they are sparse, irregular and more particularly, they project almost vertically from the margins of the lobes and in so doing, resemble the tusks of a boar. At present this unique species is known only from the type collection.

Hypotrachyna terricola Elix, sp. nov. Fig. 3

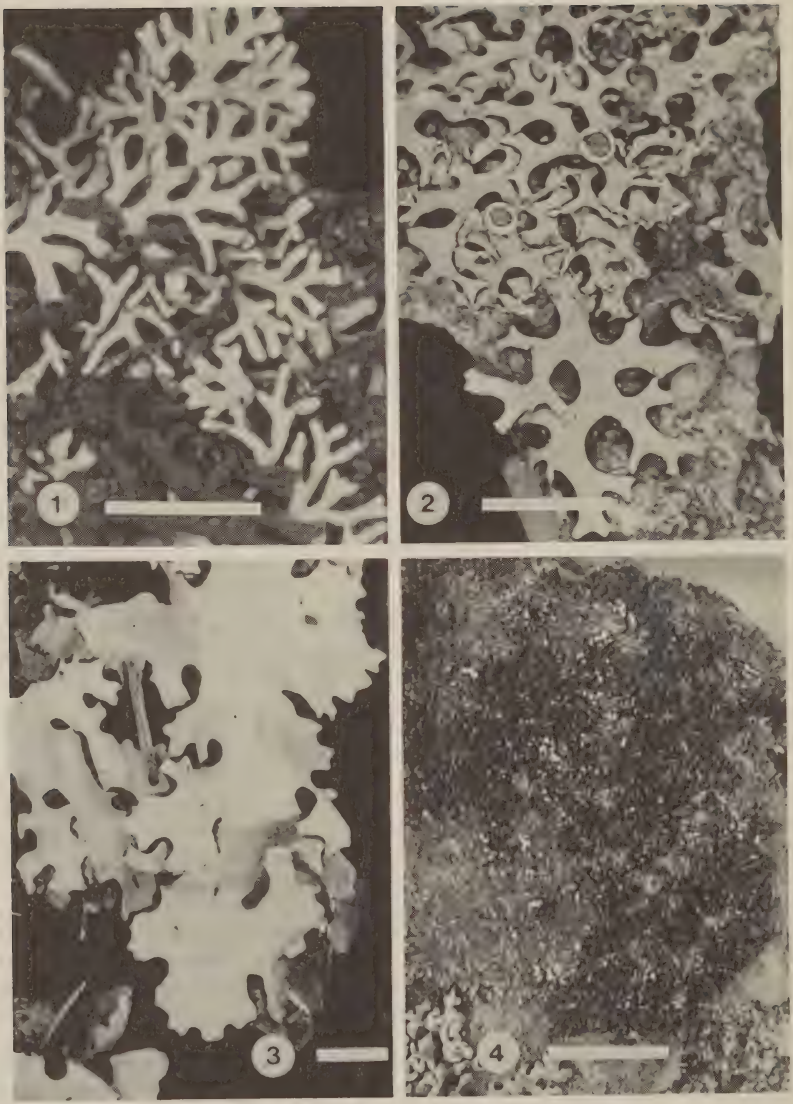
Species cum thallo ut in *Hypotrachyna costaricensis* sed ab hac specie lobis exisidiatis differt.

Type: Papua New Guinea. Southern Highlands, Tari Gap, 27 km south-east of Tari, 5°57'S, 143°10'E, 2660 m, loose on soil and over grasses, *J. A. Elix 13100 & H. Streimann*, 15.xii.1982; holo: CANB; iso: B.

Thallus foliose, loosely adnate or unattached, terricolous, from 5-8 cm wide. *Lobes* separate or loosely imbricate, sublinear to subirregular, subirregularly branched, 2-12 mm wide. *Upper surface* whitish to greenish grey, flat to slightly convex or concave, dull but shiny at apices, ±white-maculate, lacking isidia, lobules, soredia and pustules. *Medulla* white. *Lower surface* black; rhizines dense, richly dichotomously branched, forming a thick mat visible along the margins from above. *Pycnidia* and *apothecia* not seen.

Chemistry. Cortex K+ yellow; medulla K-, C-, KC-, P-; containing atranorin (major), chloroatranorin (trace), protopraesorediosic acid (major), praesorediosic acid (minor), constipatic acid (major), protoconstipatic acid (major), unknown fatty acids (minor/trace).

This species resembles *Hypotrachyna costaricensis* (Nyl.) Hale in its habitat, in having broad, sublinear to subirregular lobes and in containing analogous fatty acids in the medulla. However, whereas *H. costaricensis* is invariably isidiate, *H. terricola* lacks vegetative propagules. *Hypotrachyna flexilis* Kurok., an Asian species which contains medullary fatty acids and lacks soredia and isidia, differs in having narrower (2-6 mm *cf.* 2-12 mm



Figures 1-4. New species of Parmeliaceae: 1, *Anzia niuginiensis* (holotype in CANB); 2, *Bulbothrix tuskiformis* (holotype in CANB); 3, *Hypotrachyna terricola* (holotype in CANB); 4, *Neofuscelia convexa* (holotype in CANB). Scale bar = 5 mm.

wide), sublinear lobes which are dichotomously branched and in containing a different chemosyndrome of fatty acids. Furthermore *H. flexilis* is corticolous and typically copiously fertile. *H. terricola* appears to be endemic to the highlands of Papua New Guinea where it grows loosely attached on soil in alpine and subalpine grasslands.

Specimens Examined

PAPUA NEW GUINEA. Southern Highlands Province. Mt. Giluwe, 3 km SE of summit, 6°05'S, 143°53'E, 3750 m, on soil in alpine grassland, *H. Streimann 24272*, 12.ix.1982 (CANB). Western Highlands Province. Milep area, Minz District, on soil, *A. Vinas 7637*, ii.1981 (CANB, H, UPNG, US).

Neofuscelia convexa Elix, sp. nov. Fig. 4

Species cum thallo ut in *Neofuscelia namaënsis* sed ab hac specie laxe adnato, lobis diminutis, separatis et acido bourgeanico noncontinente differt.

Type: Australia. Western Australia. Yilliminning Rock, 18 km NE of Narrogin, 32°57'S, 117°22'E, 320 m, on large exposed granite outcrop, *J. A. Elix 41058a, H. T. Lumbsch & H. Streimann*, 12.ix.1994; holo: CANB.

Thallus minutely foliose to subcrustose, saxicolous, loosely adnate to adnate, 1-2 cm wide. *Lobes* not imbricate, separate or contiguous, sublinear, subdichotomously to irregularly branched, 0.1-0.3 mm wide. *Upper surface* dark brown to black-brown, convex, slightly shiny at the lobe apices, lacking isidia and soredia; becoming areolate in thallus centre. *Medulla* white. *Lower surface* tan to pale brown; rhizines sparse, robust, concolorous or becoming darker. *Pycnidia* and *apothecia* not seen.

Chemistry. Cortex K-, HNO_3+ pale to dark blue-green, medulla K+ yellow then orange, C-, P+ orange-red; containing norstictic acid (major), connorstictic acid (minor).

The only morphologically similar nonisidiate, subcrustose species of *Neofuscelia* with a pale lower surface known to produce norstictic acid as the major medullary constituent is *N. namaënsis* (J.Stein. & Zahlbr.) Essl., a lichen which differs in having a tightly adnate thallus, broader (0.3-1.0 mm *cf.* 0.1-0.3 mm wide), crowded lobes and in producing bourgeanic acid in addition to norstictic and connorstictic acids. In gross morphology *N. convexa* resembles *N. remnantia* Elix, since both species have small subcrustose, moderately adnate to adnate thalli with very narrow, separate lobes. However, *N. remnantia* has a black lower surface and develops sparse globose isidia on the older central lobes while *N. convexa* has a pale tan lower surface and lacks vegetative propagules. At present *N. convexa* is only known from the type locality.

Neofuscelia malcolmii Elix, sp. nov. Fig. 5

Species cum thallo ut in *Neofuscelia adpicta* sed ab hac specie subtus pallido et acido 4-*O*-methylolivetorico continente differt.

Type: New Zealand. South Island, Canterbury, Kea Point Trail, The Hermitage, Mt. Cook, 850 m, on rocks in open subalpine scrub, *J. A. Elix 9721*, 31.xii.1981; holo: WELT.

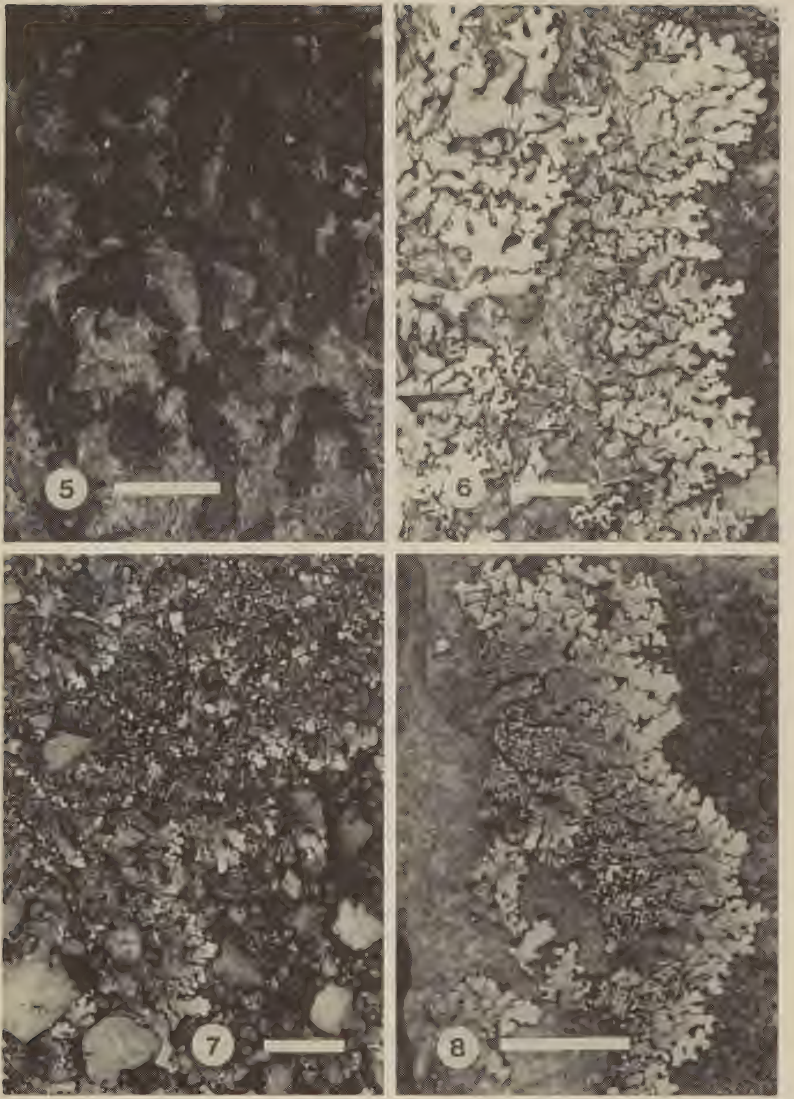
Thallus foliose, tightly adnate, saxicolous, forming irregular rosettes, 3-6 cm wide. *Lobes* radiating, separate, elongate to linear-elongate, subdichotomously branched, 1-3 mm wide, usually wider at or near the apices, narrower within the thallus. *Upper surface* dark brown to brown-black, slightly paler and red brown at the periphery, flat, lacking soredia and isidia, with apices shiny, smooth or ±irregularly pitted, older lobes becoming dull, cracked and rugose. *Medulla* white. *Lower surface* pale tan, wrinkled, naked at apices and margins; rhizines sparse, unevenly distributed, simple, pale brown. *Apothecia* common, sessile or subpedicellate, to 2 mm wide; disc shallowly concave then ±flat, dark brown, shiny; thalline exciple thin, margin entire. Ascospores ellipsoidal, 7-9 x 3.5-5.5 µm. *Pycnidia* common, immersed. Conidia bifusiform, 5.5-6.5 x 1 µm.

Chemistry. Cortex K-, HNO_3+ dark blue-green; medulla K-, C-, P-; containing 4-*O*-methylolivetoric acid (major), microphyllinic acid (minor/trace).

Morphologically this species resembles *Neofuscelia adpicta* (Zahlbr.) Essl., *N. olivetorica* Elix and *N. plana* (Essl.) Essl. as all three have stellate, tightly adnate thalli with flat lobes which are wider at the apices than centrally. However, *N. malcolmii* can readily be distinguished from these species by the colour of the lower surface, being pale tan in *N. malcolmii* but black in the other three species. These species can also be distinguished chemically since *N. adpicta* contains divaricatic acid, *N. plana* glomelliferic acid, *N. olivetorica* olivetoric acid, and *N. malcolmii*, 4-*O*-methylolivetoric acid. This endemic species seems to be rare on subalpine rocks in the mountains of the South Island. It is named in honour of the New Zealand lichenologist, Dr William M. Malcolm, noted for his excellent work on the crustose species in the region.

Specimen Examined

NEW ZEALAND. South Island, Canterbury, SW slopes of Foggy Peak, Porters Pass, Torlesse Range, 1000 m, on rocks in open subalpine heath, *J. A. Elix 19054 & J. Johnston*, 4.iii.1985 (CANB).



Figures 5-8. New species of Parmeliaceae: 5, *Neofuscelia malcolmii* (holotype in WELT); 6, *Xanthoparmelia hypoleiella* (holotype in MEL); 7, *Xanthoparmelia maccarthyi* (holotype in CANB); 8, *Xanthoparmelia mayrhoferi* (holotype in GZU). Scale bar = 5 mm.

Xanthoparmelia hypoleiella Elix, sp. nov. Fig. 6

Species cum thallo ut in *Xanthoparmelia hypoleia* sed ab hac specie arcte adnato et lobis subirregularibus differt.

Type: Australia. Western Australia. Coolgardie, 30°57'S, 121°09'E, 350 m, on rock, *H. A. Morrison;* holo: MEL 1026882.

Thallus foliose, adnate to tightly adnate, 5-8 cm wide. *Lobes* imbricate or not, flat, subirregular, subdichotomously to irregularly branched, 0.5-1.5 (3.0) mm wide; apices ±rotund. *Upper surface* yellow-green but blackening with age, dull, with distinct or effigurate maculae, lacking isidia and soredia; older lobes becoming rugulose and developing tangential cracks; lobe apices often black-margined. *Medulla* white. *Lower surface* black, moderately rhizinate; rhizines black, simple or tufted, robust, 0.5-1.5 mm long. *Apothecia* short pedicellate, 3-6 mm wide; disc concave, dark brown; thalline exciple maculate, thick, entire and involute at first but becoming dentate and cracked. Ascospores 6-8 x 4-5 µm. *Pycnidia* common. Conidia bifusiform, 0.5 x 6-7 µm.

Chemistry. Cortex K-; medulla K+ yellow-brown, C-, P+ orange-red; containing usnic acid, protocetraric acid (major) and ±virensic acid (trace).

This species is characterised by the adnate to tightly adnate thallus, the black lower surface, the effigurate maculae on the upper surface and production of protocetraric acid in the medulla. This species has previously been misidentified as *Xanthoparmelia hypoleia* (Nyl.) Hale, since both possess effigurate maculae and have similar chemistry. *X. hypoleia,* however, is clearly distinguished from *X. hypoleiella* by its loosely adnate thallus with sublinear-elongate lobes. Whereas *X. hypoleia* is confined to South Africa, *X. hypoleiella* is a rare species in Australia, occurring on rocks in coastal and temperate hinterland zones of southwestern Western Australia.

Specimens Examined

AUSTRALIA. Western Australia. Near York, on rocks, *L. Priep* (MEL 6192); half way to summit of Mt Brown lookout, York, 97 km E of Perth, on granite outcrop with southerly aspect, *N. Sammy*, 3.v.1981 (PERTH).

Xanthoparmelia maccarthyi Elix, sp. nov. Fig. 7

Species cum thallo ut in *Xanthoparmelia khomasiana* sed ab hac specie isidiis apicibus syncorticatis, nonerumpentibus, nigrescentibus et acido 4-*O*-demethylnotatico noncontinente differt.

Type: Australia. Queensland. Carnarvon National Park, track to Baloon Cave, 91 km NNW of Injune, 25°04'S, 148°15'E, 460 m, on large sandstone outcrops in *Eucalyptus* woodland, *J. A. Elix 34112*, 19.viii.1993; holo: CANB.

Thallus small-foliose to subcrustose, saxicolous, tightly adnate, 3-10 cm wide. *Lobes* congested, subirregular to sublinear, irregularly branched, 0.3-0.7 mm wide. *Upper surface* yellow-green, darkening with age, flat or weakly convex, emaculate, commonly areolate towards thallus centre, lacking soredia; isidia globose then cylindrical, simple, to 0.2 mm high, with apices syncorticate, darkening and inflated but not erumpent. *Medulla* white. *Lower surface* flat, pale brown to dark brown; rhizines sparse, simple, concolorous. *Apothecia* and *pycnidia* not seen.

Chemistry. Cortex K-; medulla K-, C-, KC+ rose, P-; containing usnic acid (major), hypoprotocetraric acid (major), scabrosin 4,4'-dibutyrate (minor).

Like *Xanthoparmelia khomasiana* Hale from southern Africa, this new species is characterized by the small-foliose to subcrustose habit, the pale lower surface, the globose isidia and the presence of medullary hypoprotocetraric acid. However, these species differ chemically and in the nature of the isidia. Thus in X. *khomasiana* the tips of the isidia are epicoticate, pale, hollow, pustular and erupt without forming soredia while in X. *maccarthyi* the tips of the isidia are syncorticate, often dark or blackened, solid and intact. The two species also differ in their minor chemical constituents; *X. maccarthyi* containing scabrosin 4,4'-dibutyrate in addition to usnic acid and hypoprotocetraric acid, while *X. khomasiana* lacks scabrosin 4,4'-dibutyrate but contains 4-*O*-demethylnotatic acid. The only other isidiate species containing hypoprotocetraric acid in Australia is *Xanthoparmelia weberi* (Hale) Hale, which differs in having much broader lobes (0.8-3.0 mm wide) and isidia with epicorticate apices. At present this species in known only from the type collection. It is named in honour of the Australian lichenologist, Dr Patrick M. McCarthy, noted for his excellent work on pyrenocarpous lichens.

Xanthoparmelia mayrhoferi Elix, sp. nov. Fig. 8

Species cum thallo ut in *Xanthoparmelia exillima* sed ab hac specie subtus brunneo et isidiis globosis, erumpentibus differt.

Type: Australia. Queensland. Port Douglas, NE of Cairns, SE end of Island Point, *ca*. 20 m, on rock outcrops near the shore, *H. Mayrhofer 11363 & E. Hierzer*, 7.viii.1993; holo: GZU.

Thallus small-foliose to subcrustose, saxicolous, tightly adnate, 1-2 cm wide. *Lobes* congested, sublinear, irregularly branched, 0.2-0.4 mm wide, without lobules. *Upper surface* yellow-green, darkening with age, flat or weakly convex, dull, emaculate, commonly areolate towards thallus centre, lacking soredia; isidia moderately dense, globose, mainly simple, to 0.3 mm high, with apices epicorticate, inflated but rarely erumpent, not sorediose. Medulla white. *Lower surface* flat, brown, dark brown to black at apices; rhizines sparse, simple, stout, concolorous. *Apothecia* and *pycnidia* not seen.

Chemistry. Cortex K-; medulla K-, C-, KC+ rose, P-; containing usnic acid (major), norlobaridone (major), subnorlobaridone (minor).

Previously this species has been confused with *Xanthoparmelia exillima* (Elix) Elix & J. Johnst. or *X. orchardii* Elix, since all three are characterized by tightly adnate, small-foliose to subcrustose thalli with an isidiate upper surface, a pale or brown lower surface and the presence of medullary norlobaridone. However they can clearly be separated by the nature of the isidia and the colour of the lower surface. The apices of the isidia are syncorticate, noninflated, intact and often dark or blackened in *X. exillima* but are epicorticate, inflated and occasionally bursting open in the other two species. Further, the isidia are squat and globose in *X. mayrhoferi* but cylindrical or coralloid with inflated apices in *X. orchardii*. The lower surface also differs, being pale ivory to tan in *X. exillima* and *X. orchardii* but mid- to black brown in *X. mayrhoferi*. These species also differ in the nature of their minor chemical constituents. Thus *X. orchardii* contains loxodin in addition to usnic acid and norlobaridone, while *X. mayrhoferi* and *X. exillima* contain norlobaridone and subnorlobaridone. This new species is named in honour of the Austrian lichenologist and collector, Dr. Helmut Mayrhofer.

Specimen Examined

AUSTRALIA. Queensland. Plover Plain on Mt. Fox to Kennedy Development Road, 45 km N of Greenvale, 18°34'S, 144°55'E, 600 m, on semi-exposed rock outcrop in *Leptospermum* dominated seasonal swampy area, *H. Streimann 46827e*, 19.xii.1990 (CANB).

Notes on Lichen Chemistry

The cortical chemistry reported for the following species (Elix 1996) was in error. The observed chemistry for these species is as follows:

Paraparmelia bourgeanica Elix, *Mycotaxon* **59**: 410 (1996).
Chemistry. Cortex K+ yellow; medulla K-, C-, P-; containing atranorin, bourgeanic acid (major), conbourgeanic acid (minor).

Paraparmelia inselbergia Elix, *Mycotaxon* **59**: 412 (1996).
Chemistry. Cortex K+ yellow; medulla K+ yellow becoming dark red, C-, P+ orange; containing atranorin, salazinic acid (major), consalazinic acid (minor), constipatic acid (minor/trace), protoconstipatic acid (minor/trace).

ACKNOWLEDGEMENTS

I thank the Australian Research Council for generous financial support of this work. I also wish to thank the staff of the Photographic Unit, ANU, for preparing the photographs, Mr. D. Verdon for checking the Latin descriptions and the following colleagues and herbaria for making collections available: Ms. Jen Johnston (CANB), Dr. N. Marchant (PERTH), Dr. H. Mayrhofer (GZU), Dr. J. Ross (MEL), and Mr. H. Streimann (CANB).

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A NEW SPECIES OF *PSEUDAEGERITA* FROM ITALY

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ABSTRACT

A new species of ***Pseudaegerita*** isolated in pure culture from a decaying twig of ***Quercus*** submerged in a river bank in Siena province, Italy, is described and illustrated. A key to differentiate the species of the genus is included.

Key words: ***Pseudaegerita***, aero-aquatic fungi, hyphomycetes, Italy.

RESUMEN

Se describe e ilustra una nueva especie de ***Pseudaegerita*** que fue aislada en cultivo puro a partir de una rama de ***Quercus*** en descomposición colectada en el lecho de un río de la provincia de Siena, Italia. Se incluye una clave dicotómica para la diferenciación de las especies de dicho género.

Palabras clave: ***Pseudaegerita***, hongos aeroacuáticos, hifomicetes, Italia.

INTRODUCTION

While attending the "IV Giornate della Confederazione della Micologia Mediterranea" held in Siena, Italy, in November 1996, the authors collected submerged decaying leaves and twigs from streams and rivers in Siena province. The samples were washed several times with tap water, placed on moist filter paper in 15 cm diam. polystyrene Petri dishes and incubated at 15ºC under cool white light. After one week, the samples were examined for the presence of fungi with the help of a dissecting microscope. Several interesting aero-aquatic conidial fungi were found sporulating on the decaying leaves and twigs. A new species of ***Pseudaegerita*** Crane & Schoknecht is herein described and illustrated.

DESCRIPTION AND DISCUSSION

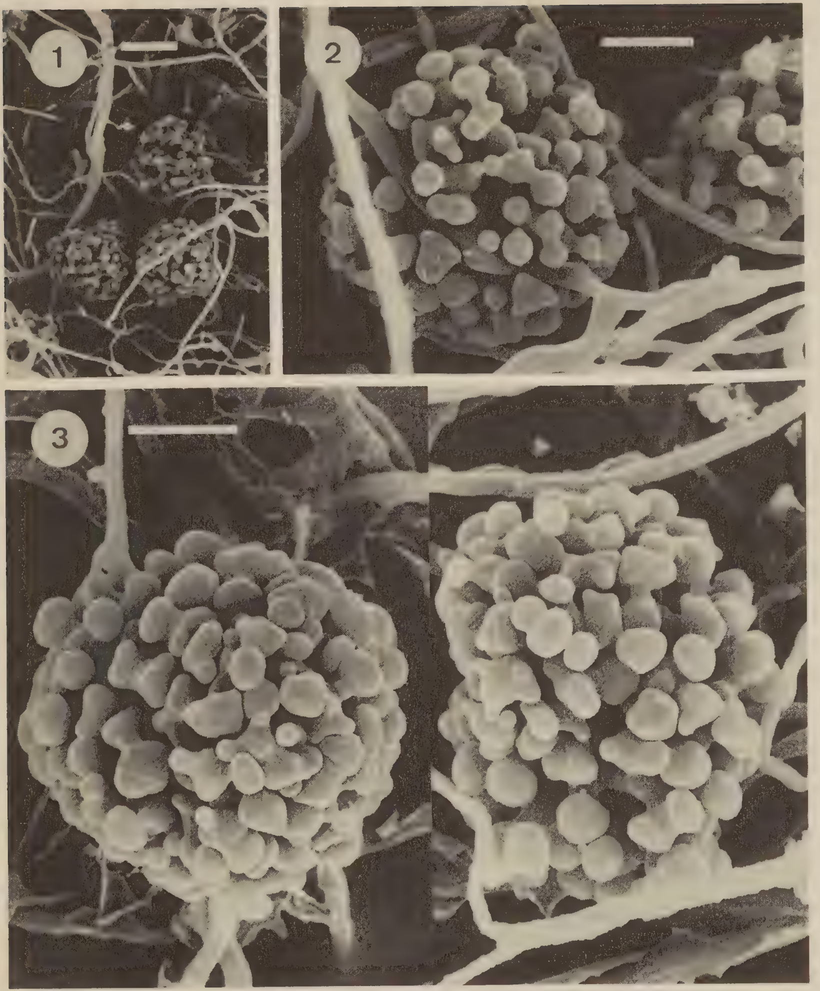
Pseudaegerita ossiformis Abdullah, Gené *et* Guarro, *sp. nov.* Figs 1-3

Coloniae in agaro maltoso 0.2 % ad 15°C 3 cm diam. post 14 dies. Mycelium partim superficiale et partim in substrato immersum, ex hyphis pallide brunneis vel atrobrunneis, septatis, 2.5-3 μm latis compositum; chlamydosporae intercalares, 6-8 μm latae. Conidiophora solitaria, mononematosa, semimacronematosa vel macronematosa, simplicia, dilute brunnea, usque ad 150 μm longa, 3-4 μm lata. Cellulae conidiogenae polyblasticae, integratae. Conidia sphaerica vel subsphaerica, 50-100 μm diam., viridulogrisea vel olivaceogrisea, spisse ramosa; rami ex cellulis subangularibus cum extremis curvis compositi, 4-5 μm diam., in statu maturo non fatiscentes. Status phialidicus non observatus.

Colonies on 0.2% MEA attaining 3 cm diam. in two weeks at 15ºC, mycelium superficial and immersed; hyphae light brown to dark brown, septate, 2.5-3 μm wide; chlamydospores intercalary, 6-8 μm wide. Conidiophores solitary, mononematous, semimacronematous to macronematous, simple, arising from the submerged mycelium, light brown, up to 150 μm tall, 3-4 μm wide. Conidiogenous cells polyblastic, integrated. Conidial propagules spherical to subspherical, 50-100 μm diam., greenish grey to olive grey under reflected light, composed of a compact branched system of subangular cells with rounded ends, often triangular or quadrangular, 4-5 μm diam., each successively budding out 1-4 daughter cells; conidia not breaking up into fragments, compact, retaining air between cells. Phialidic state not seen.

Etymology: The specific epithet refers to the bone-like shape of the conidial cells.
Habitat: Isolated from a decaying ***Quercus*** twig in a small river, near Monticiano, Siena province, Italy, 5 November 1996, coll. S.K. Abdullah.
Holotype: IMI 375018, dried sporulating culture on 0.2% MEA.
Isotype: FMR 5942.

The genus ***Pseudaegerita***, erected by Crane and Schoknecht (1981), is based on ***Oidium corticale*** Peck. Abdullah and Webster (1983) enlarged the concept of the genus to include species previously disposed in ***Aegerita*** Pers. ex Fr. and ***Papulaspora*** Preuss. The genus is characterized by developing conidial propagules composed of a compact, highly branched system of torulose, globose or ellipsoidal cells, each successively budding out 1-4 daughter cells, retaining air between the cells and lacking clamp connections. ***Pseudaegerita*** comprises five species. ***Pseudaegerita corticalis*** (Peck) Crane & Schoknecht, the type species,



Figs 1-3. SEM photographs of ***Pseudaegerita ossiformis*** (IMI 375018). Scale bars: **1** = 20 μm; **2**, **3** = 10 μm.

is the anamorph of the inoperculate discomycete ***Hyaloscypha lignicola*** Abdullah & Webster. ***Pseudaegerita viridis*** (Bayliss & Elliot) Abdullah & Webster is based on ***Aegerita viridis*** Bayliss & Elliot. ***Aegerita candida*** Pers. ex Fr., the type species of ***Aegerita***, is characterized by forming white, ovoid conidial propagules composed of centrifugally arranged septate hyphae ending with a broad apical cell and bearing clamps at all the septa. ***Pseudaegerita viridis***, apart from the absence of clamp connections, is basically different from ***A. candida*** in the structure and development of its conidial propagules. ***Pseudaegerita matsushimae*** Abdullah & Webster is based on ***Papulaspora viridis*** Matsushima. According to Weresub and Le Clair (1971), ***Papulaspora*** is restricted to fungi developing papulospores, which are small rounded propagules comprising one or more enlarged central cells surrounded by a sheath of smaller cells. More recently, Matsushima (1996) described ***P. caffera*** Matsushima from an aquatic habitat in South Africa. All species of ***Pseudaegerita*** were found on decaying leaves and twigs of diverse plants lying on the banks of rivers and streams or from stagnant water bodies. The new species shows some similarity with ***P. matsushimae*** in developing compact propagules which are not easily broken into their component cells, but it can be easily distinguished by its smaller conidial propagules, and by its also smaller component cells.

KEY TO THE SPECIES OF *PSEUDAEGERITA*

1a. Conidia breaking easily into their component cells 2
1b. Conidia not breaking into their component cells 4
2a. Conidia up to 500 μm diam., varying in colour; component cells 3-5 μm diam. .... ***P. corticalis***
2b. Conidia mostly over 500 μm diam., olive green or dark green in colour 3
3a. Conidia dark green, up to 700 μm diam.; component cells 4-7 μm diam.; microconidial state abundant in old cultures .... ***P. viridis***
3b. Conidia olive green, up to 1000 μm diam.; component cells 4-6 μm diam.; microconidial state not seen .... ***P. caffera***
4a. Conidia up to 450 μm diam.; component cells 7-10 μm diam.; microconidial state abundant in old cultures .... ***P. matsushimae***
4b. Conidia up to 100 μm diam.; component cells 4-5 μm diam.; microconidial state not seen .... ***P. ossiformis***

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SYNCARPELLA RIBIS SP. NOV. AND ITS ANAMORPH, SYNTHOLUS RIBIS GEN. ET SP. NOV.

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ABSTRACT

A new species of *Syncarpella*, a genus previously reported only on Asteraceae, is described from *Ribes* of the Grossulariaceae. The anamorph is a new species and eustromatic genus, *Syntholus*, whose strongly erumpent conidiomata usually precede the ascomata on a common hypostroma.

Keywords: coelomycete, loculoascomycete, *Syncarpella*, *Syntholus*

INTRODUCTION

For several years, collections of dead twigs of *Ribes wolfii* Rothrock from the San Juan National Forest, Engineer Mountain Quadrangle, between Engineer Mountain and Greysill Mountain, have included a fungus with strongly erumpent, usually multilocular conidiomata on a basal stroma up to 2.5 x 1.5 mm. Each locule has one or more ostioles and is slightly or nonpapillate. The conidia are orange-brown, globose, smooth, thick-walled, and born on discrete phialidic conidiogenous cells. Recent collections of the fungus contain groups of ascomata on the basal stromata with spent conidiomata of the coelomycete. The ascomycete is an undescribed species of *Syncarpella*, a genus previously found only on members of the Asteraceae.

Syncarpella Theissen and H. Sydow belongs to the Cucurbitariaceae, and like those of *Cucurbitaria* (type species: *C. berberidis* Pers.), the species are commonly found on woody stems, usually in strongly erumpent groups on a shared basal stroma. The genus comprises six species that until now have been disposed in a number of genera and only recently grouped under *Syncarpella* (Barr & Boise 1989). Synonymy is cited in Barr and Boise (1989).

TAXONOMY

Syncarpella ribis A. W. Ramaley & M. E. Barr, sp. nov., FIGS. 1-10.

Ascomata solitaria vel plerumque aggregata base stromatica vetere anamorphis, separata vel aliquando confluentia, juventute globosa, turbinata vel globosa ubi matura, apapillata, plerumque aliquantum depressa prope ostiolum, 500-825 μm diam, atribrunnea, interdum nitore metallico. Peridium usque ad 120 μm crassum, cellulis et catervis cellularum protrudentibus, strata exteriora ex laminis cellularum dense pigmentiferarum, parvarum, crassitunicatarum constantia, laminae per suturas ex catervis cellularum parvarum, hyalinarum vel subpigmentiferarum separatae; strata interiora cellulis grandioribus, plerumque pseudoparenchymatibus crassitunicatis, hyalinis vel luteolis, interdum subbrunneis vel pigmentiferis inequalibus, magis uniformiter aetate fuscantibus. Ostiolum indistinctum, ex fissura parva, poro rotundato, vel lamina elevata peridii constans, in sutura apicali vel caterva cellularum subpigmentiferarum inter laminas peridii evolutans, aliquot periphyses breves formatae ubi ostiolum crescit; peridium prope ostiolum ex stratis exterioribus cellularum dense pigmentiferarum, crassitunicatarum et stratis interioribus numerosis cellularum perparvarum, crassitunicatarum, hyalinarum constans. Asci bitunicati, cylindracei, stipitati, 184-216 x 12.8-16.8 μm, stipes 30-55 μm. Pseudoparaphyses tenues cellulis nonnullis inflatis, anastomosantes et ramosae, abundantes. Ascosporae ellipsoideae vel ellipsoideae-fusiformes, 21.6-30.4 x 8.8-11.2 μm, (2-) 3 (-4, 5)-septatae, aureobrunneae subpallidae, leves, moderate crassitunicatae, uniseriatae imbricatae in asco.

ANAMORPHE. Syntholus ribis A. W. Ramaley & M. E. Barr, gen. nov.

HABITATIO. In ramunculis mortuis Ribes wolfii Rothrock

HOLOTYPUS. "U.S.A. COLORADO: San Juan Co., ca. 2.5 miles up forest service road 579, Cascade Divide Road, near Purgatory Resort, 29 May 1995," *Annette Ramaley 9529 (UC 1496906; ISOTYPUS BPI 737897, COLO F-18266, DAOM .*

Ascomata (FIG. 1, 5, 6) single or more often grouped on the old stromatal base of the anamorph, separate or sometimes confluent, globose when young, turbinate or globose at maturity, lacking a papilla, usually somewhat sunken near the ostiole, 500-825 μm diam, dark brown, sometimes with a metallic sheen. Peridium (FIG. 4) up to 120 μm thick, with projecting cells or groups of cells, the outer layers consisting of plates of heavily pigmented, small, thick-walled cells, the plates separated by sutures consisting of groups of small hyaline to lightly pigmented cells; inner layers of larger cells, usually thick-walled, hyaline to yellowish pseudoparenchyma, sometimes light brown or unevenly pigmented, darkening more uniformly in age. Ostiole indistinct, consisting of a small slit, rounded pore, or raised plate of the peridium, developing in an apical suture or group of the lightly pigmented cells between plates of the peridium (FIG. 1), a few short periphyses formed as the ostiole develops; the wall near the ostiole consisting of outer layers of heavily pigmented, thick-walled cells, and numerous inner layers of very small, thick-walled hyaline cells. Asci (FIG. 2) bitunicate, cylindric, stipitate, 184-216 x 12.8-16.8 μm, the stipe 30-55 μm. Cellular pseudoparaphyses thin with some inflated cells, anastomosed and branched, plentiful. Ascospores (FIG. 3) ellipsoid to ellipsoid-fusiform, 21.6-30.4 x 8.8-11.2 μm, (2-) 3 (-4, 5)-septate, rather pale golden brown, smooth, moderately thick-walled, overlapping uniseriate in the ascus. A variant is known with clavate to cylindric asci as short as 125 μm. The ascospores vary from the usual shape to obovoid to clavate. Ascospore arrangement is overlapping uniseriate, overlapping biseriate, and intermediates between these two states.

Syntholus A. W. Ramaley & M. E. Barr, gen. nov.

ETYMOLOGY. Syn-, together, plus *tholus*, dome, referring to the several dome-shaped locules, separate above, usually constituting the conidiomata.

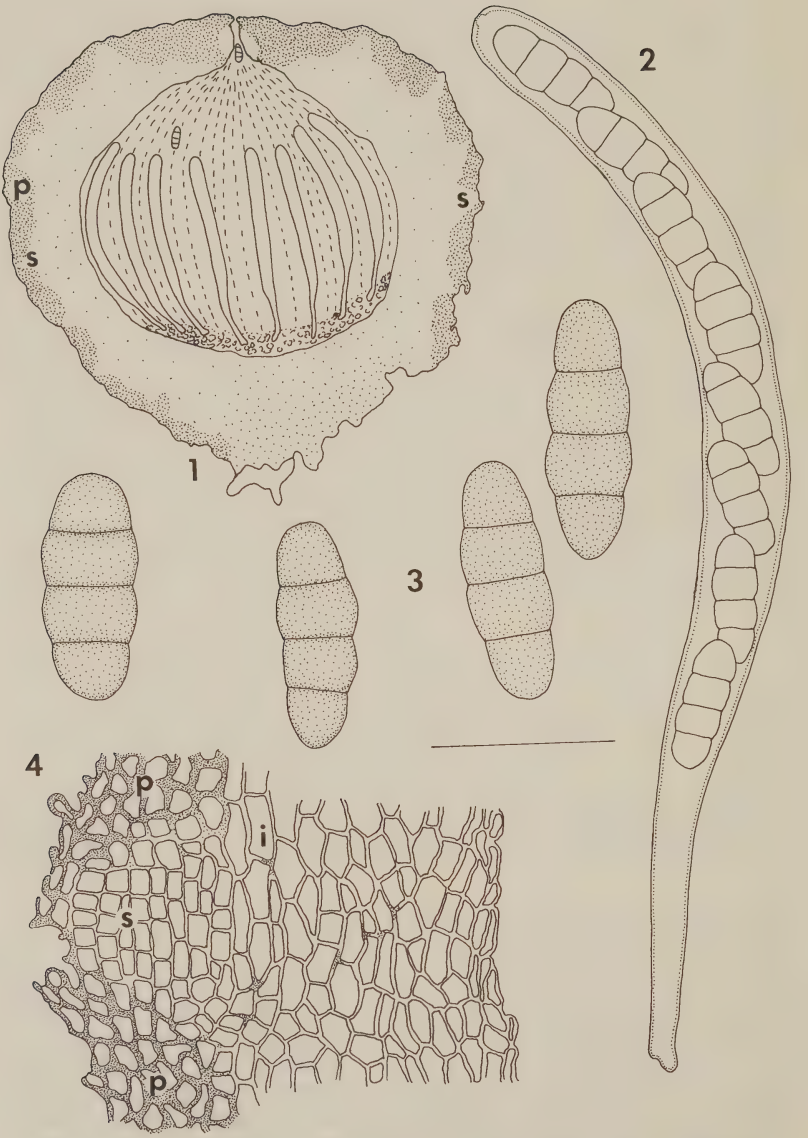
Conidiomata eustromatica, initio immersa demum valde erumpentia, multilocularia vel raro unilocularia; vertice loculi plus minusve distinguibiles, infere separati per columnas ex pseudoparenchymatibus hyalinis vel subbrunneis constantes, apapillati vel leviter papillati, omni ostiolo uno vel plus quam uno. Conidiophora absentia. Conidia aseptata, crassitunicatis. Microconidia pariete supero prope ostiolum et canale ostioli formata.

SPECIES TYPICA. Syntholus ribis A. W. Ramaley & M. E. Barr, sp. nov.

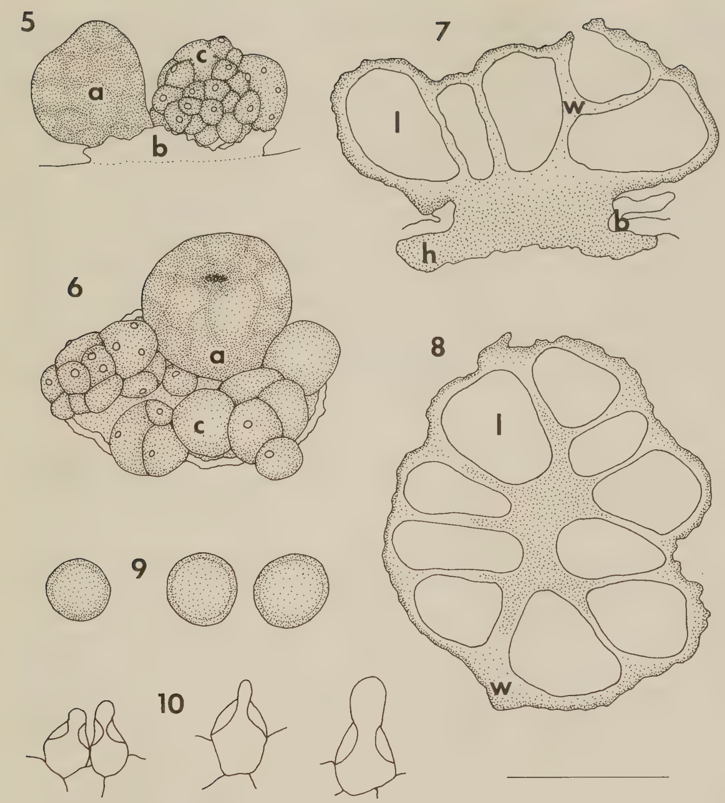
Conidiomata eustromatic, at first immersed but strongly erumpent, multilocular or rarely unilocular; the locules more or less distinct above, separated below by columns of hyaline to pale brown pseudoparenchyma, non- or slightly papillate, each with one or more ostioles. Conidiophores absent. Conidiogenous cells enteroblastic phialidic, determinate, discrete. Conidia aseptate, thick-walled. Microconidia formed on the upper wall near the ostiole and in the ostiolar channel.

Syntholus ribis A. W. Ramaley & M. E. Barr, sp. nov., FIG. 5-10.

Conidiomata eustromatica, initio immersa demum valde erumpentia, atribrunnea, interdum nitore metallico, catervae erumpentes conidiomatum circulares vel ellipsoideae, 250-2500 x 250-1500 μm, multilocularia vel raro unilocularia; vertice loculi plus minusve distinguibiles, infere separati per columnas ex pseudoparenchymatibus hyalinis vel subbrunneis constantes, crassiparietibus, paries exterior atribrunneus, cellulis et catervis cellularum protrudentibus, strata exteriora cellularum dense pigmentifera, strata interiora hyalina vel luteola vel subbrunnea. Loculi apapillalti vel leniter papillati, usque ad 500 μm diam sed typica ca 200 μm diam, omni ostiolo uno vel plus quam uno 30-40 μm diam. Conidiophora absentia. Cellulae conidiogenae ampulliformes, enteroblasticae, phialidicae, determinatae, discretae,



FIGS. 1-4. *Syncarpella ribis* (holotype). 1. Longitudinal section of ascoma. 2. Ascus. 3. Ascospores. 4. Part of longitudinal section of ascoma wall. i=inner wall; p=heavily pigmented plate; s=suture. Standard line: 1=250 μm; 2=33μm; 3=20μm; 4=50μm.



FIGS. 5-10. *Syncarpella ribis* (holotype). FIGS. 7-10 *Syntholus ribis* anamorph (holotype). 5, 6. Habit of ascoma and accompanying anamorph conidiomata. 7. Longitudinal section of conidioma. 8. Transverse section of conidioma. 9. Conidia. 10. Conidiogenous cells. a=ascoma; b=bark of substrate; c=conidioma; h=hypostroma; l=locule; w=wall. Standard line: 5, 6=800 µm; 7, 8=500µm; 9, 10=20 µm.

hyalinae, leves. Conidia globosa, 8-9.6 µm diam, aseptata, levia, crassitunicata. Microconidia pariete supero prope ostiolum et canale ostioli formata.

HABITATIO. In ramunculis mortuis Ribes wolfii Rothrock

HOLOTYPUS. "U.S.A. COLORADO: San Juan Co., ca. 2.5 miles up forest service road 579, Cascade Divide Road, near Purgatory Resort, 6 July 1991," *Annette Ramaley 9103 (UC 1496907; ISOTYPUS BPI, COLO F-18267).*

Conidiomata (FIG. 5-8) eustromatic, at first immersed but later strongly erumpent through periderm, dark brown, sometimes with a metallic sheen, erumpent groups of conidiomata 250-2500 x 250-1500 μm, circular to ellipsoid, multilocular or rarely unilocular; locules more or less distinct from above and separated below by columns of hyaline to pale brown pseudoparenchyma, thick-walled, the outer wall dark brown, with protruding cells and groups of cells, the outer cell layers heavily pigmented, inner layers hyaline to yellowish to light brown. Locules non- or slightly papillate, up to 500 μm diam but usually ca 200 μm diam, each with one or more ostioles 30-40 μm diam. Conidiophores absent. Conidiogenous cells (FIG. 10) ampulliform, enteroblastic, phialidic, separate, determinate, discrete, hyaline, smooth, periclinal wall thickened. Conidia (FIG. 9) globose, 8-9.6 μm diam, aseptate, orange-brown, smooth, thick-walled. Microconidia formed on upper wall near the ostiole and in the ostiolar channel, globose, 4-5.6 μm diam, aseptate, hyaline, smooth.

All measurements and drawings were made from field collections. Hand sections of ascomata and conidiomata were mounted in tap water for study of internal structures.

Cultures of the coelomycete were prepared by suspending conidia in a drop of sterile tap water on the surface of potato dextrose agar (PDA, Difco) in a petri plate and spreading the drop with a sterile glass rod. Growth from single conidia was transferred to PDA slants. Cultures of the ascomycete were prepared by crushing an ascoma in a drop of sterile tap water and transferring suspended ascospores to a drop of sterile tap water on the surface of PDA in a petri plate and spreading the drop with a sterile glass rod. Growth from single ascospores was transferred to PDA slants. Cultures were maintained at room temperature (RT) on a table top. Test tubes containing twigs of *Ribes wolfii* and five ml of water agar were sterilized and slanted. Inoculum from a *Syncarpella* culture was placed at the twig-agar junction where some bark had been removed. After two months growth at RT, some tubes were placed in the refrigerator and the other tubes were maintained at RT.

In petri plates, colonies from conidia and ascospores were zonate with varying shades of nearly white to brown, the reverse darker, but also zonate. After one month, white hyphal aggregations appeared, visible from above and below as white spots on the brown reverse. Some aggregations became raised above the colony surface, a few were stromatic, lobed and hollow, fewer still were brown on the surface. None of the cultures produced conidia. Growth on sterile *Ribes* twigs developed hyphal aggregates at RT, but no conidiomata or conidia were formed. In about three months, brown, lobed, ostiolate structures appeared in all tubes with *Ribes* twigs that were refrigerated after growth from the *Syncarpella* inoculum had been established. The structures contained orange-brown, globose conidia typical of *Syntholus*. These conidia produced colonies indistinguishable from *Syncarpella* colonies derived from ascospores. The close association of *Syncarpella ribis* ascomata with *Syntholus ribis* conidiomata in nature as well as the cultural results indicate these fungi are phases of a single life cycle.

When maturing freshly collected ascomata of *Syncarpella ribis* are examined, the ascospores are rather pale golden brown. Within two months after collection, the golden pigment is mostly absent. The ascospores become light clear brown and the septa appear darker than the outer walls, resembling ascospores of *Melanomma* Nitschke *ex* Fuckel in the Melanommatales. However, the presence of cellular pseudoparaphyses places *S. ribis* in the Pleosporales (Barr 1987).

There are several differences between *Syncarpella ribis* and other species of the genus, the most obvious being the substrates--Grossulariaceae for *S. ribis*, and Asteraceae for all other species. In addition, the asci of *S. ribis* are mostly cylindric with overlapping uniseriate ascospores rather than clavate or oblong with overlapping biseriate ascospores as is true for the other species. The peridium of *S. ribis* is three layered as in other family members, but the outer peridium, particularly of young ascomata, consists of plates of thick-walled, heavily pigmented cells, smaller than the wall layers they enclose, separated by groups of small, thick-walled, hyaline or lightly pigmented cells. These sutured plates are not reported for other *Syncarpella* species. Some collections of *S. tumefaciens* (Ellis & H. W. Harkness) Theissen & Sydow and *S. occidentalis* (Ellis) M. E. Barr & Boise have an accompanying pycnidial coelomycete assumed to be the anamorph. For the 'anamorph' of *S. occidentalis*, conidia, perhaps spermatia, are rod-shaped, 3-4 x 0.5-1 μm, aseptate, and hyaline (Barr & Boise 1989). In contrast, the *S. ribis* anamorph has larger, deeply pigmented condia more closely resembling the *Camarosporium, Coniothyrium,* and *Phaeoseptoria* anamorphs of other Cucurbitariaceae.

The pigmented, aseptate conidia, discrete phialidic conidiogenous cells, and multilocular conidiomata of *Syntholus* are characters shared by *Cytoplea* Bizz. & Sacc. *in* Bizz. Petrak and Sydow (1927) provided the only full treatment of *Cytoplea*. They recognized that the genus might well be divided into two or more genera, but chose only to divide it into two subgenera whose types were not congeneric (Sutton 1980). Sutton therefore again recognized *Cyclothyrium* Petrak as a genus including the type, *C. juglandis* (Schum. *ex* Rabenh.) Sutton, and related species.

Ribes was linked, if only doubtfully, to three of the thirteen species discussed by Petrak and Sydow. None of these species could be confused with *Syntholus ribis*. *Cyclothyrium juglandis* was thought a possible inhabitant of *Ribes* twigs, but this species is the anamorph of *Thyridaria rubro-notata* (Berk. & Br.) Sacc. *Cyclothyrium insitivum* (Sacc.) Sutton was considered, but regarded as a doubtful designation, for some specimens from *Ribes* twigs. Unless development is particularly good, it is identified with certainty only if accompanied by the teleomorph, *Valsaria insitiva* (Tode:Fr.) Ces. & de Not. Cultural studies of *V. insitiva* (Glawe 1985) placed the pycnidial state of this fungus in *Cytosporella*

Sacc., not *Cyclothyrium* or *Cytoplea*! *Cytoplea parasitica* Petrak was described from *Ribes* twigs, but though Petrak and Sydow believed it might be found in the bark of these twigs, the conidiomata they examined were embedded in ascomata of *Discostroma* Clem. (as *Phragmodothella*). The conidia were rod-shaped, 3-4.5 x 1-1.5 μm, and only colored pale yellow or olive brown en mass. The teleomorph of this fungus was not cited, but the anamorph could not be mistaken for *Syntholus*.

Syntholus is distinguished not only from the '*Cytoplea*' species on *Ribes* dealt with by Petrak and Sydow, but *Cytoplea* and *Cyclothyrium* as presently delimited (Sutton 1980). (1) Neither *Cytoplea* nor *Cyclothyrium* has definite ostioles; each locule of *Syntholus* has one or more schizogenous ostioles with associated microconidia. (2) The immersed, convoluted groups of multilocular conidiomata of *Cyclothyrium* are embedded in a subiculum; the strongly erumpent conidiomata of *Syntholus* are mounted on a hypostroma. Conidiomata of *Cytoplea* are pulvinate (Sutton 1980) whereas *Syntholus* has locules that are more or less separate at the top and joined below. Individual locules may be easily identified by separate domes from above, or only discerned by the location of several ostioles in a mound of tissue. (3) *Cytoplea* is epidermal to subepidermal in leaves or culms of grasses whereas *Cyclothyrium* and *Syntholus* are found on twigs of woody dicotyledons. *Cyclothyrium* remains immersed in the substrate and *Syntholus* is strongly erumpent through the bark. (4) *Syntholus* conidia are orange-brown, smooth, thick-walled spheres whereas *Cytoplea* conidia are oval to ellipsoid and verrucose to warty. *Cyclothyrium* conidia are pale brown and short-cylindric with more or less truncate bases.

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MUCOR TROGLOPHILUS, A NEW SPECIES FROM CAVE CRICKETS

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Abstract

A new species of *Mucor*, *M. troglophilus* Zalar, is described from a cave in Slovenia, in association with the cave cricket *Troglophilus neglectus*. The species is closely related to *M. bacilliformis*, but differs by the shape and size of the sporangiospores, of the columellae and of the arthrospores, and by the natural ability of producing a persistent yeast phase in aerobic as well as anaerobic conditions.

Introduction

During the investigation of the fungal diversity in a Slovenian cave and particularly of the mycoflora associated with cave inhabiting fauna, several hyphomycetes and zygomycetes were found on living larvae and adults of cave crickets, *Troglophilus neglectus,* and their cadavers. Among the isolated Mucoraceae, a species of *Mucor* was repeatedly isolated from both different parts of dead and living cave crickets, that proved to be closely related to *Mucor bacilliformis* Hesseltine (Hesseltine 1954), but differing by a number of characters. The species is here described as new.

Material

Type. MZKI B-543 (collecting n° T75A1), isolated from living *Troglophilus neglectus*, in Mengore cave, Tolmin, Slovenia, collected by S. Jeram, isolated by P. Zalar, on 23 March 1996. It is kept as dried culture on Synthetic Mucor Agar SMA (Hesseltine 1954) in MZKI mycological herbarium, National Institute of Chemistry, Ljubljana, Slovenia. Ex type living culture MZKI B-354 is kept in the MZKI Culture Collection.

Specimens examined. Paratype specimens of *Mucor troglophilus*: MZKI B-540 (T70F1), B-533 (T59E1), B-536 (T61B1), B-500 (T-42A2), isolated by P. Zalar, from sexual organs, gut and frass of living adults and from the gut of a living larva respectively of *Troglophilus neglectus* from Mengore cave, Tolmin, Slovenia, collected by S. Jeram, 23 March 1996. All isolates are preserved as dried cultures in MZKI mycological herbarium and as living cultures in MZKI Culture Collection. *Mucor bacilliformis* Hesseltine MZKI 584 = NRRL 2346 = ATCC 128590 = CBS 251.53.

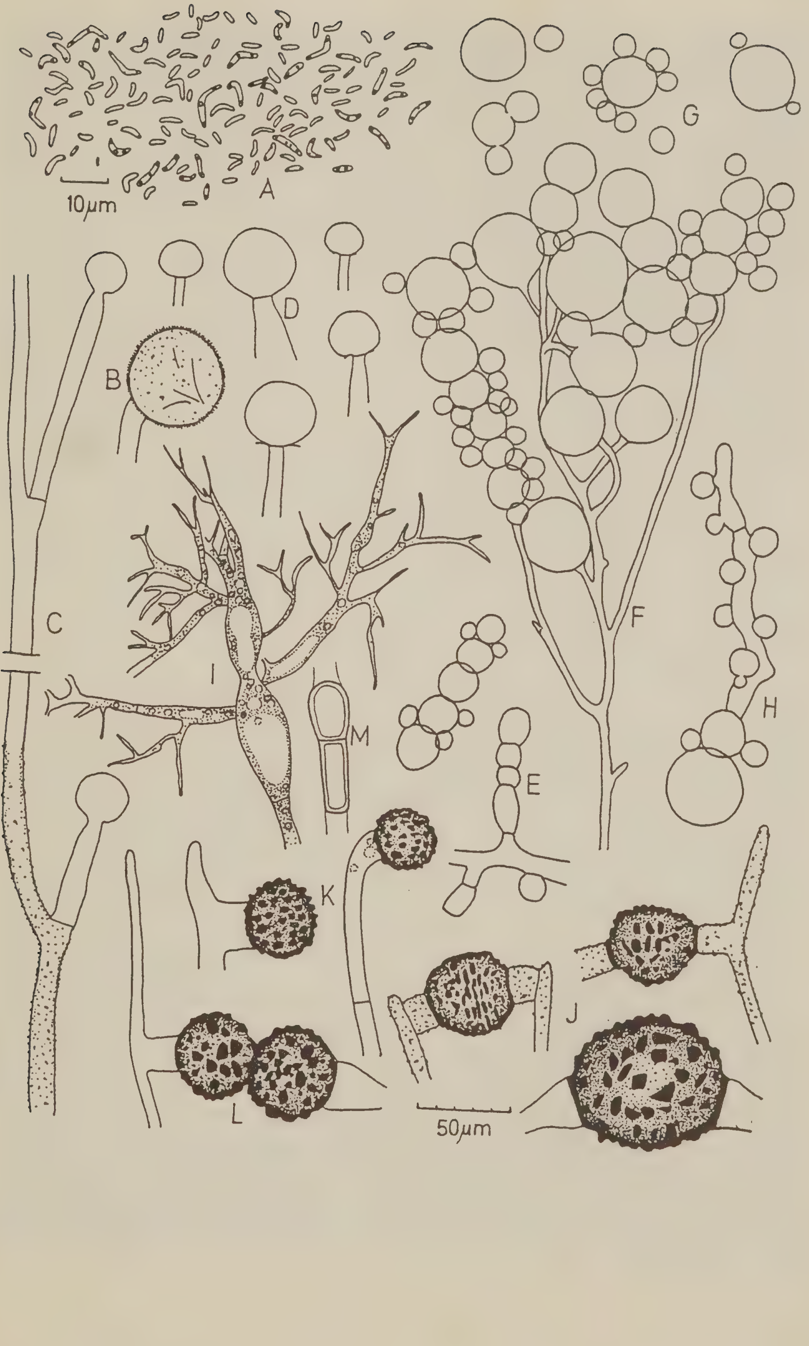
Culture media used: Synthetic Mucor Agar (SMA), Potatoe Dextrose Agar (PDA, OXOID), Malt Agar (MA; malt extract DIFCO).

DESCRIPTION

Mucor troglophilus Zalar sp. nov. (Fig. 1, 2)

Coloniae in SMA, 20°C, diei luce, primo levuriformes crescentes, albo-luteae, lobatae, radialiter plicatae, tarde filamentosae, 33 mm in diametro in 10 diebus. Mycelium effusum, luteolo-album, 6 mm altum, margina irregulare, immersum et multe ramosum, aromaticum, homothallicum. Hyphae 10-20 µm latae, marginales multe ramosae, in centro cum ultimis ramulis rhizoideis saepe cum solitariis vel gregariis inflatis giganteis 100-150 x 20-40 µm cellulis. Sporangiomata abundantia, ex immersis vel superficialis hyphis. Sporangiophori usqued 30 µm longi, primo 10 µm erecti, tarde recurvati ad substratum et formantes secondarias levuriformes colonias, 3-19 µm lati, simplices, interdum sympodialiter ramosi, laeves sed rugulosi ad basim, constricti ad sporangium. Sporangia sphaerica, pallida et translucentia, tarde luteo-brunnea, brillantia, 43-216 µm, hyalina, crustoso et evanescente pariete. Columellae applanatae, interdum globosae, 21-51 µm latae, 17-53 µm altae, medio 36 x 34 µm, hyalinae, laeves, collario interdum absente. Sporangiosporae hyalinae, luteo-brunneae in quantitate, cylindricae, rectae, curvatae, angulares vel helicoideae, 1.5-9.8 x 0.8-1.2 µm, medio 4.2 x 0.9 µm, laeves, bi- vel multiguttulatae. Zygophori subapicaliter ferentes pallide brunneos, laeves vel rugulosos, similes, 25-30 µm in diametro suspensores et apicaliter attenuati et steriles. Zygosporae sphaericae, 38-85 µm, medio 59,5 µm, in diametro usque ovoideae, 80 x 68 µm, brunneae vel brunneo-nigrae, verrucosae cum 10 x 5 µm verrucis. Azygosporae zygosporis similes, ad zygosporas vel ad singulum suspensorem natae. Chlamydosporae intercalares, solitariae vel catenatae, crasso pariete, 8-23 x 8-15 µm. Arthroblasticae cellulae (conidia) holoblasticae, apicales vel laterales, solitariae vel basipetaliter catenatae, hyalinae, 12-45 µm in diametro, caduces, levuriformes, producentes polyblasticae holoblasticae,

Fig. 1. *Mucor troglophilus*. A-L, from type strain MZKI B-543; K, from MZKI B-523. A, sporangiospores, 600 x; B, sporangium; C, sympodially branched sporangiophore; D, columellae; E, arthrospores; F, hyphae with solitary and catenate yeast forming arthrospores; G, budding yeast cells; H, mixed yeast and hyphal growth of arthrospore; I, giant hyphal cells with rhizoids; J, zygospores; K, solitary azygospore on one suspensor; L, coupled (a)zygospores between suspensors; M, chlamydospores; B-M, 240 x.


A
10µm
G
B
D
F
C
I
M
E
H
K
J
L
50µm

primo globosae, obpyriformae vel ellipticae, et ad maturitatem sphaericas et usquead 45 µm, levuriformes cellulas. Habitat in subterraneis cavis socio com *Troglophilo neglecto*, in Slovenia. Typus: MZKI B-543, e vivente *Troglophilo neglecto* in Mengore cavis, Tolmin, Slovenia, 23 martio 1996.

The description is based on the type strain MZKI B-543 and four other isolates.

Colony on SMA at 20°C in day light, at first growing as yeast during 1-2 days or more, then becoming, or not, mycelial and sporulating in all parts of the mycelium, up to 33.5 mm in radial growth, 6 mm in height, 5.5 mm of intramatricial depth in 10 days.

Mycelium: effuse, superficial or immersed, obverse and reverse colored yellowish white (Methuen 2A2-3A2); margin irregular, immersed, abundantly branched; odor fragrant of marsupine.

Hyphae: varying from 10 to 20 µm in width; branches of the main hyphae in the mature parts of the colony are producing abundant *giant cells* intercalary or laterally, intramatricial or superficial, solitary or aggregated, sometimes in chains, variable in shape, delimited by septa, densely granulated, 20-50 µm wide, 40-110 µm long, averaging 33.5 x 95 µm, terminating with much branched rhizoidal structures; lateral branches from both marginal or central areas may produce terminal, solitary or catenate swollen spherical arthroblastic cells, delimited by septa and budding as yeast.

Sporangiophores: erect until about 10 mm long, then bending with increasing length to 20 to 30 mm over the colony as to reach the medium outside the margin; they are 3-19 µm wide, unbranched or sometimes once or twice sympodially branched, straight, hyaline, smooth becoming rough at the lowest part, often constricted under the sporangium.

Sporangia: spherical, pale and hyaline when young, light yellowish brown at maturity, shining, 43-216 µm in diameter, apparently smooth; sporangium wall hyaline, minutely crustose, evanescent at sporangium maturity.

Columellae of mature sporangia mostly applanate, sometimes globose, hyaline, smooth, 21-51 µm wide, 36 µm in average, 17-53 µm high, 34 µm in average, collar conspicuous or absent.

Sporangiospores: hyaline, yellowish brown in mass, cylindrical, variable in shape and size, straight, curved, boomerang-shaped or helicoidal, average 4.2 x 0.9 µm , 1.5-10 x 0.8-1.2(1.5) µm, smooth, bi- to multiguttulate, germinating by repetitive holoblastic budding in both aerobic and anaerobic conditions.

Sexual behaviour: homothallic.

Fig. 2. *Mucor troglophilus*, upper row: columela and chlamydospores (strain B-523), zygospore (B-533); middle row: satellite yeast colonies (B-543, type), budding catenate arthrospores (B-536); lower row: colony on SMA at 10 days (B-500) and sporangiospores (B-543, type).

Zygophores bearing at different distances from the sterile apex, light brown, smooth to rough-walled, short, cylindrical to conical, of equal shape and size, 19-32 µm, 27.5 µm average in length, 19-28.5 µm, 23 µm average in diameter, suspensors.

Zygospores: developing from the suspensors, spherical (38-85 µm, 59.5 µm average) to ovoid (80 x 68 µm) with brown to brownish black, thick and warted wall; warts up to 10 x 5 µm.

Azygospores: often double or solitary on single suspensors, brown, 40-50 µm diameter, with thick and warted wall.

Chlamydospores: rare, intramatricial, intercallary in hyphae, solitary or catenate, limited by septa, slightly laterally swollen, with thickened wall and yellowish with granular content, not seceding, 8-23 x 8-15 µm.

Arthroblastic conidia: intramatricial and superficial, holoblastic, solitary, terminal or lateral on hyphal branches, or more frequently produced in basipetal chains, at first of molioid shape, later spherical and easily seceding, hyaline, 12-45 µm in diameter, budding as yeast when still attached to hyphae or after secession.

Yeast phase: yeast-like colony developing from multisporangiospore inoculation, or as satellite colonies from sporangia of bended sporangiophores, extending up to 1 to 8 mm in diameter in 10 days and eventually further until hyphal growth appears, lobate in outline, mat, furrowed in surface, creamy in colour, soft in texture.

Yeast cells: budding holoblastically and multilaterally from sporangiospores or arthrobastic conidia or other yeast cells, into daughter cells, globose, obpyriform or eliptical when young, becoming spherical, hyaline, up to 45 µm in diameter.

Habitat. In caves, associated with different parts of larvae and adults *Troglophilus neglectus*, periodically cave inhabiting cave cricket, and of their cadavers, in Slovenian cave, at 10-13°C and almost 100% relative humidity.

Etymology. The species is called *troglophilus* in regard of its habitat, its psychrophilic tendency and its association with the cave inhabiting insect *Troglophilus neglectus*.

A comparison between *M. bacilliformis* type strain and *M. troglophilus* strains of growth characteristics on different culture media at 20°C (Tab. 1) was made.

On PDA, *M. troglophilus* grows as a yeast on the first day, develops hyphae on the second, and sporulates and produces zygospores in the centre from the third day on. *M. bacilliformis* does not form yeast colonies, grows faster, sporulates abundantly from the second day on, and produces zygospores from the third day on.

On MA 4%, *M. troglophilus* develops either a yeast or a mycelial colony, sporulates abundantly from the second day on, and zygospores appear disperse on the second or third day. *M. bacilliformis* does not grow yeast like, sporulates abundantly from the second day on and forms zygospores from the fifth day on. On MA 8%, *M. troglophilus* grows either yeast-like or mycelial. It abundantly produces both sporangiospores and zygospores in the centre of the colony, from the second day on. *M. bacilliformis* sporulates abundantly as well, from the second day on, but does not produce zygospores so frequently.

	growth rate/ 8 days	**yeast/mycelial phase**	**satellite yeast colonies**	**mycelium structure**
PDA 2 %				
M.b.	54 mm	-/+	-	low, concentric; margin regular
M.t.	32 mm	+/+ or -	+ or -	cottony; margin immersed, irregular
MA 4 %				
M.b.	60 mm	-/+	-	arrachnoid, effuse; margin regular
M.t.	45 mm	+/+ or -	-	abundant, arachnoid; margin irregular
MA 8 %				
M.b.	80 mm	-/+	-	cottony, concentric; margin regular
M.t.	66 mm	+/+	-	dense, cottony, zonate; margin regular

Table 1: Growth differences and similarities between type strain *of M. bacilliformis (M.b.)* and strains of *M. troglophilus (M.t.)*.

Growth rates at different temperatures also differentiate the two species (Tab.2).

	SMA	PDA	MA 4%	MA 8%
5°C				
M.b.	no record	23 mm	40 mm	25 mm
M.t.	10 mm	16 mm	44 mm	46 mm
25°C				
M.b.	> 80 mm	> 80 mm	> 80 mm	> 80 mm
M.t.	15 mm	9 mm	18 mm	18 mm

Table 2: Growth rates of *M. bacilliformis (M.b.)* and *M. troglophilus (M.t.)* after 30 days at 5°C and 25°C.

Anaerobic condition under CO_2 pressure is known to induce yeast formation in a number of *Mucor* species (Bartnicki-Garcia & Nickerson, 1962). Sporangiospores of both type strains of *M. troglophilus* and *M. bacilliformis* have been submitted to pure CO_2 at 1 atm. pressure, at 20°C on SMA. We recorded differences between two species (*M. troglophilus=M.t., M. bacilliformis=M.b.*(Fig.3)) after 7 days of incubation (Tab.3).

	yeast colony			yeast cells			hyphae
	diameter (mm)	structure	margin	shape	diameter (µm)	budding type	%
M.b	< 1.5	mat, cerebroid	irregular	spherical	< 25	holoblastic, spherical to ellipsoidal	10
M.t.	< 2.5	shining	regular	spherical	< 45	holoblastic, spherical	/

Table 3: Differences in growth of *M. bacilliformis (M.b.)* and *M. troglophilus (M.t.)* in pure CO_2 atmosphere.

The fungus has been regularly found on living *Troglophilus neglectus* adults, and at one occasion on a larva. Whether the fungus is associated with the insect, either used as food, since it has been isolated from the gut of living individuals, or as a pathogen, is presently under investigation. It should be noticed that *M. bacilliformis* was isolated twice from different substrates, soil in North America (Hesseltine 1954) and agarics in Asia (Schipper 1978).

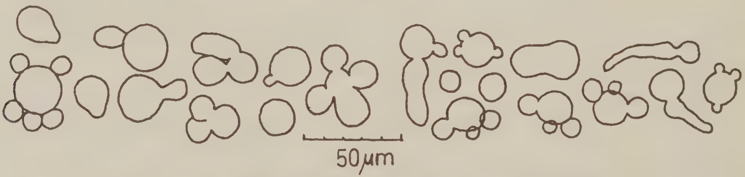


Fig. 3. Yeast phase of *Mucor bacilliformis* Hesseltine type strain NRRL 2346, in anaerobic CO_2 atmosphere, after 7 days, 240 x.

DISCUSSION

Mucor troglophilus differs from *M. bacilliformis* Hesseltine by several morphological diagnostic characters.

Columellae are larger in size in *M. troglophilus* (Tab. 4). They are most frequently applanate and more rarely globose, as in *M. bacilliformis*, beside being also applanate and ovoid (Hesseltine 1954, Schipper 1978) Hesseltine's and Schipper's measurements of columellae of *M. bacilliformis* differs from ours measurements of the type strain (Tab. 4).

M. troglophilus differs by shape and size of sporangiospores. The shape and size of sporangiospores as described above for *M. troglophilus* are constantly observed in the five isolates, without variation. Sporangiospores of *M. troglophilus* are frequently elongate and curved, boomerang-shaped or helicoidal. Although the range of measurements of *M. troglophilus* sporangiospores includes that of sporangiospores of *M. bacilliformis* (Tab.4), the species differs significantly by their longest spores and also in their average size.

		columellae (µm)	sporan.spores (µm)	arthrospores (µm)	giant cells (µm)
M.b.	Hesseltine	26.6 x 21	3.6(-5.5) x 1.3	< 35	< 60
	Schipper	< 30	4(-6.5)x1-1.3	/	< 60
	Zalar	17.5 x 15.6	3.6(-4.5)x1.3	< 19	< 38
M.t.	Zalar	36 x 34	4.2(-10) x 0.9	< 45	33.5 - 95

Table 4: Differences of measured parameters between *M. bacilliformis (M.b)* type strain and strains of *M. troglophilus (M.t.)*.

Arthrospores are differing by size (Tab.4) and abundant budding. Young arthrospores of *M. troglophilus* are ovoid when terminal, barrel-shaped when catenate. All mature arthrospores are spherical. Arthrospores of *M. bacilliformis* wild type strain do not bud in the given standard conditions.

Giant cells are always elongate in *M. troglophilus*, while in *M. bacilliformis* they are globose.

The species differ also in their behaviour in culture. The cultural behaviour of *M. troglophilus* differs mainly by the natural ability of sporangiospores to germinate readily by yeast-like budding and by the development of large yeast colonies in aerobic conditions. In such conditions, the yeast colony can subsist until a diameter of 20 to 30 mm in 20 days at 20°C, before developing or not the first hyphae. According the description of Hesseltine (1954) and Schipper (1978), sporangiospores of *M. bacilliformis* type strain do not germinate by yeast budding in aerobic conditions but by hyphae, which was confirmed by our observations. However, the type strain of *M. bacilliformis* submitted to phenethyl alcohol, an inhibitor of hyphal growth, showed yeastlike growth as well (Terenzi & Storck 1969). The same type strain also produced respiratory deficient mutants either spontaneously or experimentally induced by N-methyl-N'-nitro-N-nitrosoguanidine mutagen which grow exclusively yeastlike in aerobic condition (Storck & Morrill 1971, Ruiz-Herrera, Ruiz & Lopes-Romero 1983, Ruiz-Herrera 1985).

In the hyphal state, the type strain of *M. bacillformis* and *M. troglophilus* strains differ in growth rate. *M. troglophilus* has a growth rate of 34 mm in diameter in 10 days which is half of *M. bacilliformis* growth rate of 76 mm in diameter in 10 days, in our measurements, at 20°C.

Furthermore very long sporangiophores that bend toward the medium at the edge of the colony are observed in *M. baciliformis* and in *M. troglophilus* as well as in many other *Mucor* species, in *M. troglophilus*, however, sporangial satellite colonies are constantly yeast-like.

In anaerobic conditions under 1 atm. CO_2 pressure, similarly to the type strain of *M. troglophilus*., *M. bacilliformis* type strain developed a yeast phase (Fig. 3). The two species, however, show differences in size and development of the yeast cells. *M. bacilliformis* produces smaller yeast cells, with a maximum diameter of 25 µm, versus 45 µm in *M. troglophilus*, and reveals a tendency to hyphal growth that *M. troglophilus* does not.

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PHOMOPSIS AZADIRACHTAE SP. NOV. FROM INDIA

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Abstract

A new species of coelomycete, *Phomopsis azadirachtae* infecting *Azadirachta indica* in India, is described.

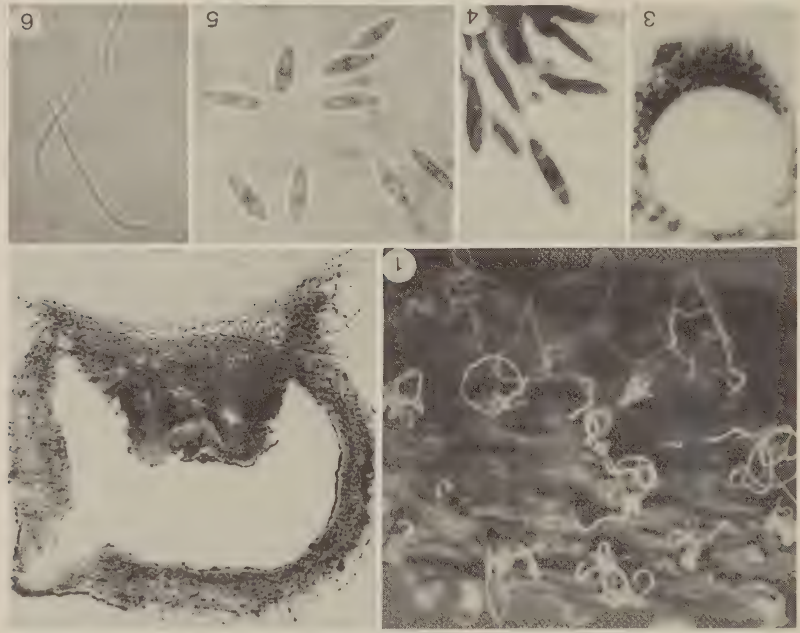
Neem (*Azadirachta indica* A. Juss.) trees in India showing characteristic die-back symptoms consistently yielded a species of *Phomopsis*. Uecker (1988) describes the difficulties in identifying unknown species of *Phomopsis*. The name *Phomopsis* is a nomen conservandum (Riedl et al., 1981). Wechtl (1988, 1990) made detailed morphological and anatomical studies on genitype *Phomopsis lactucae* and several other species occurring on Compositae and Umbelliferae. Uecker (1988) published a world list of *Phomopsis* species on different host plant species. Comparison of the *Phomopsis* species isolated from *A. indica* with the earlier described species, *Phomopsis abdita* (Sacc.) Traverso on *Melia azedarach* L.(Uecker, 1988; Bilgrami *et al.*, 1991; Ellis & Ellis, 1985) revealed that it was not described previously. This is the first report of a *Phomopsis* species on *A. indica* from India.

Phomopsis azadirachtae **sp. nov.** (Figs. 1-6)

Mycelium immersum, ramosum, septatum, hyalinum, tandem pallide brunneum. Conidiomata pycnidica, solitaria vel aggregata, immersa-erumpentia, pallide brunnea vel atro brunnea vel nigra, ampulliformia vel subglobosa, uniloculadaria, crassitunicata, composita ex textura angularia, uniforma, cono basali turgescente endogeni ex luminibus cellularum majorum, exterio melanocea, magnit, 300-500 μm alta et 900 μm lata in sectionis, clypeis basalis minutis. Ostiolo singulario, circulario, papillato. Conidiophora simplicia vel ramosa, brevia vel elongata septata, filiformia, hyalina; conidiophora in palliside estratis interioris locularis producta, 12-20 x 1.6-2.0 μm. Cellulae conidiogenae phialideae, subulata vel filiformia, integratae vel discretae, canale et collulo minutis, hyalinae, spissitudine periclinali crassa vel non, 5-8 x 1.6-3 μm, alpha et beta conidia producentes, conidia acropleurogena. Conidia bi-typa, exerto in cremeo vel luteo mucoso cirrho. Alpha-conidia hyalina, fusiformia, recta, 2-4 guttulata, laevia, aseptata, 4.8-11.2 x 1.6-3.2 μm, germinantia prompta; beta-conidia hyalina, filiformia, hamata, eguttulata, aseptata, 16-25.6 x 1.6-2.0 μm, germinantia incognita.

Holotypus in ramulis siccis *Azadirachta indica*, Mysore (Karnataka), India. Leg. Sateesh, 1996. Herb. HCIO 42119 & MUBH 983.

Mycelium immersed, branched, septate, profuse, colourless, becomes pale brown later. **Conidiomata** pycnidial, solitary or aggregate, half-immersed, pale brown to dark brown or black, ampulliform or subglobose, unilocular, thick-walled textura angularis uniform throughout with the endogenous basal swelling cone with lumina of bigger cells (Wechtl, 1988, 1990), outer layers melanised, 300-500 μm high, up to 900 μm wide in sections, very short basal clypei (Wechtl, 1988, 1990). **Ostiole** single, unilocular, circular, papillate. **Conidiophores** simple or branched, short or elongate, septate, filiform, hyaline, line the inner layer of locule, 12-20 x 1.6-2.0 μm. **Conidiogenous cells** phialidic, subulate or filiform, integrated or discrete, channel and collarette minute, hyaline, periclinal thickenings of variable thickness, 5-8 x 1.6-3 µm, produce both alpha-conidia and beta- conidia, conidia acropleurogenous. **Conidia** of two types, in a cream to dark yellow coloured slimy cirrhi: **alpha-conidia** hyaline, fusiform, straight, 2-4 guttulate, smooth, aseptate, 4.8-11.2 x 1.6-3.2 µm, germinate readily; **beta-conidia** hyaline, filiform, hamate, eguttulate, aseptate, 16-25.6 x 1.6-2 µm, germination unknown.



Figs. 1-6. ***Phomopsis azadirachtae.*** Fig. 1. A diseased twig of *Azadirachta indica* with cirrhi oozing from conidiomata of *Phomopsis azadirachtae* (x 40). Fig. 2. Vertical section of a conidioma (x50). Fig. 3. Surface-view of conidioma produced on PDA medium with oozing cirrhus (x 40). Fig. 4. Short conidiophore with conidiogenous cell (x1000). Fig. 5. Fusiform, biguttulate alpha-conidia (x1000). Fig. 6. Filiform, hamate beta-conidia (x 1000).

Phomopsis species are known to be pathogenic to various cultivated and wild plants especially in the tropical region causing die-back, blight and canker (Uecker, 1988; Blanchard & Tattar, 1981; Kulik, 1984; Igoe *et al.*, 1995). Tewari (1992) referred to an unpublished report (Khan, *ined.*) of a die-back and twig blight of *A. indica* caused by an unidentified species of *Phomopsis* in New Forest, Dehra Dun, India , but did not elaborate and describe the species. There was no prior report of *Phomopsis* occurring on *A. indica* (Wehmeyer, 1933; Sutton, 1980; Uecker, 1988; Bilgrami *et al.*, 1991; Ellis & Ellis, 1985). Sutton (1980) recognised a few species of *Phomopsis* and opined that the genus needed revisionary studies. Further, Uecker (1988) said that it was difficult to identify the species if the *Phomopsis* species was isolated from a new/unreported host. Brayford (1990) was of the opinion that host association is not the definitive basis for delimiting the species of *Phomopsis*. For the newly established keys in Wechtl (1988; 1990) the host is not necessary as new characters are found. Rehner and Uecker (1994) reported that a species of *Phomopsis* could infect more than one host. Ormeno-Nunez *et al.* (1988) identified a new species of *Phomopsis* isolated from field bindweed (*Convolvulus arvensis* L.) based on the morphology of conidiomata, the size and shape of alpha-conidia, the size of conidiogenous cells, and colony appearance. Uecker and Johnson (1991) separated two *Phomopsis* species occurring on *Asparagus officinalis* L. based on special characters and virulence to their host. During the present study, the *Phomopsis* isolate from *A. indica* was compared with the *Phomopsis abdita* (Sutton, 1980; Uecker, 1988) on *Melia azedarach* an allied species of the same Meliaceae family. The isolate was also cross inoculated to *M. azedarach* to test host specificity.

The isolate resembled *Phomopsis abdita* only in the length of alpha-conidia, but it differed from *P. abdita* in the shape, size and structure of conidiomata, presence of beta-conidia and lacked any teleomorphic phase (Table 1). *P. abdita* had relatively small-sized, convoluted or unilocular conidiomata. Further, beta-conidia were not reported, but the teleomorphic phase *Diaporthe abdita* (Uecker, 1988) was present.

Table 1.
Comparison of characters of *Phomopsis abdita* and *Phomopsis azadirachtae*

Character	***P. abdita****	***P. azadirachtae*****
Pycnidial size	100 x 100 μm	300-500 x up to 900 μm in section Mean: 400 x 600 μm
Pycnidial shape	Globose to linear	Ampulliform or subglobose
Pycnidial locule	Convoluted/unilocular	Strictly unilocular
Alpha-conidia	8-10 x 2 μm	Range 4.8-11.2 x 1.6-3.2 μm Mean: 9.4 x 2.4 μm
Beta-conidia	None	Present; 16-25.6 x 1.6-2 μm Mean: 22.6 x 1.6 μm
Conidiophores	Branched; 30 x 2-3 μm	Simple, rarely branched; 12-20 x 1.6μm
Teleomorph	*Diaporthe abdita*	Unknown

* Data from Sutton (1980) and Uecker (1988) ** Data from 500 measurements

Attempts were made to induce the teleomorph on sterilized natural substrates, seeds and twigs of soybean, lima bean, neem and on different culture media (Table 2). However, the teleomorphic phase was not produced on any of the natural substrates and media. Beta-conidia of *P. azadirachtae* were found on the infected host tissue in natural environmental conditions. Further, the isolate was unable to infect the *Melia azedarach*. Thus, the *Phomopsis* species isolated from *A. indica* is limited only to *A. indica* in its pathogenicity, but not to the allied taxon *M. azedarach* of the same family, which harbours *Phomopsis abdita*.

Table 2.
Media tested for teleomorph production in *Phomopsis azadirachtae*

1. Carrot Agar (2 g/l)
2. Corn Meal Agar (Hi-media, Bombay)
3. Czapek-Dox Agar (Hi-media, Bombay)
4. Harrold Agar (Tuite, 1969)
5. Leonian Agar (Tuite, 1969)
6. Malt Extract Agar (Hi-media, Bombay)
7. Oat Meal Agar (Hi-media, Bombay)
8. Petri Medium (Tuite, 1969)
9. Pontecorvo Minimal Medium (Tuite, 1969)
10. Sach's Medium (Tuite, 1969)
11. Soya Meal Agar (5 g/l)
12. Tur-dhal Agar (5 g/l)
13. V-8 Juice Medium (Hi-media, Bombay)
14. Water Agar (2 g/l)
15. Yeast Extract Agar (Tuite, 1969)

The difference in the shape, size and structure of conidiomata, presence of beta-conidia in naturally infected host tissue and absence of teleomorph in both host tissue and media tested, distinguish the present isolate from *Phomopsis abdita* of *Melia azedarach*. Hence the *Phomopsis* species isolated from *Azadirachta indica* is considered as a new species based on the distinctive cultural and morphological characteristics, as well as its limited host range. The species is named *Phomopsis azadirachtae*.

Acknowledgements

We are highly grateful to Dr. Elfriede E. Wechtl, Vienna Natural History Museum, Austria, for critical review of the manuscript and helpful comments. We thank Dr. (Mrs.) Alaka Pande, Agarkar Research Institute, Pune, for the latin diagnosis. We also thank Dr. P. S. B. Gowda, Virginia University, U. S. A., Prof. D. J. Bhat, Goa University, Dr. G. R. Shivamurthy and Dr. H. G. V. G. Urs, Mysore University for their technical help and suggestions. Our sincere thanks are due to the University of Mysore for facilities and the senior author acknowledges the financial assistance from U. G. C., New Delhi.

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MYCOTAXON

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BOOK REVIEWS

Eric H.C. McKenzie, Book Review Editor

New Zealand Lichens: Checklist, Key, and Glossary by W.M. Malcolm and D.J. Galloway (1997). vi + 192 pp. A4. Museum of New Zealand Te Papa Tongarewa, PO Box 467, Wellington, New Zealand (e-mail: mail@tepapa.govt.nz). ISBN 0 909010 40 4. NZ$39.95.

This book is an unexpected delight, belying its seemingly dry title. An interesting layout and profuse use of illustrations make it a book to savour. There are 16 pages of colour photographs and paintings. The checklist of 1415 taxa in 308 genera occupies 52 pages, but imaginative use of light shading of the references, and the inclusion of photographs, turns this section into a come-on. The genera and species are listed alphabetically, with from one to several complete references for each genus - not necessarily those pertinent only to the New Zealand reader. In fact, there is no indication of who recorded each species from New Zealand, something I would have expected in a checklist.

A glossary of over 600 entries is interspersed with illustrations of almost 300 of the features listed, including delightful photographs of *Tephromela atra* 'invading a pebble' and of a Morris Minor car providing a substrate for the growth of parmelioid lichens. There are eleven strictly dichotomous keys to various groups of lichens and, in many instances, the reader is referred to an illustration of the genus or species.

With its profuse use of illustrations, this book bears the hallmark of having been prepared by a teacher. There are diagrams of the ascus apex iodine reaction for over 70 genera. In addition, there are sections on the structure of a perithecium, making preparations of spores, microscope technique, sectioning, iodine reaction, spot-tests for secondary metabolites, and preparation of formulas.

The book is robustly ring-bound, in landscape orientation. It is designed to open flat, to fold back on itself and, presumably, to fit on the desk beside a microscope. High-quality coated paper ensures that the photographs are crisp and that they show excellent detail. I suggest that this book will appeal to the amateur enthusiast and to students, as well as to the serious lichenologist. Due to the varied topics covered in this book, and to the fact that less than half of the lichen species listed are endemic to New Zealand, its use should extend beyond those with an interest only in New Zealand lichens.

E. McK.

Distribution Maps of Plant Diseases (1996). 25 x 15 cm. CAB International, Wallingford, U.K. (WWW pages: http://www.cabi.org). ISSN 0012 396X. £80, £63 Member Country, $140 Americas.

CAB International, through the International Mycological Institute and its forerunners, has been issuing *Distribution Maps of Plant Diseases* since 1942. To date 730 maps, some running to at least 7 editions, have been published at irregular intervals. They cover fungi, bacteria, viruses, and viroids.

Starting with maps issued December 1996 a new computer production system has been developed, with some improvements and some serious disadvantages as compared with earlier versions. Each map conveys less information than the older editions, and it is slightly smaller. It does not convey pictorially information that a pathogen may be restricted to part of a country. No longer is the approximate distribution demarcated by a line, but rather the country of occurrence is shaded and marked with a black dot. Thus, the vast land areas of Canada, China, or Australia are shaded and have a single dot, while small countries such as Pacific island and Caribbean nations are obliterated by their dot, or joined together by a plethora of dots. Also, the new maps lack such fundamental reference points as the equator, tropics of Cancer and Capricorn, and degrees of latitude.

At first glance it may be difficult to discern the distribution of a particular organism. For example, when examining map 714 which shows the distribution of *Ciborinia camelliae*, the eye is immediately drawn to the U.S.A., perhaps overlooking the dots on Japan and New Zealand. In mitigation, on the reverse of each sheet the occurrence for each country is listed. For larger countries, including Canada, the U.S.A., Russia, India, China, Indonesia, and Australia, subnational records are given when available. Such information is essential when some pathogens, such as *Magnaporthe salvinii* (map 448) on rice, are considered. The map alone gives the impression that rice and its pathogen occurs from Cape Horn to the outer extremities of the Canadian Northwest Territories, or the New Siberian Islands in the Russian Far East.

One may be hard pressed to ascertain 'area freedom' from these maps. For instance, *Ciborinia camelliae* occurs only in the North Island of New Zealand, but the country dot is marked over the South Island. For Australia, many of the mapped diseases are restricted to areas of the east and/or west coasts. Few of these would also occur in the arid interior.

Country listings on the back of the maps are now given in alphabetical order. No longer are they grouped together under continental headings such as Africa, Asia, Australasia & Oceania, Europe, or North America. This has both advantages and disadvantages. It is easy to look up the name of a chosen country, but if one does not know the name of the country that is shaded on the map - and for me this applies in particular to some of the African nations - then it is necessary to scan all the country names and perhaps come to a decision by elimination. For other users such a dilemma may apply to the numerous islands of the Pacific or West Indies. Perhaps CAB International could periodically issue a map with the current names of countries and other synonyms. The maps appear to be using current names for all countries. In past editions there has been an apparent reluctance to use post-colonial names for some countries.

An innovation is to indicate the extent or status of a pathogen within a country. This is done using codes developed by EPPO (European and Mediterranean Plant Protection Organization). There are four categories of incidence. An X indicates that the pathogen is present in a country, but there are no details on distribution or intensity of occurrence. Otherwise it may be noted as widespread, of restricted distribution, or known from few occurrences. Similarly, there are five codes to indicate absence - not established, eradicated, intercepted only, unconfirmed, and declared never to occur. Not surprisingly, most country occurrences are marked with an X. However, some of these are perhaps contradictory. Both *Cronartium quercuum* (map 708) and *Stenocarpella maydis* (map 724) are listed as 'present, no details' for the U.S.A. However, the former fungus is then listed as occurring in 30 states and the latter in 38. I would have expected this to qualify as 'present, widespread'. On the other hand, *Mycosphaerella linicola* (map 18) is said for New Zealand to be 'present, few occurrences'. In Herb. PDD there are 25 collections of this fungus, from most areas of the country and Dingley (1969, *N.Z. Department of Scientific and Industrial Research Bulletin 192*) stated that its widespread incidence and epidemic status added to instability of the linen flax crop.

For some country records an IMI herbarium number is given. This is commendable, but should not preclude the additional notation of a published record. The authority for the occurrence of *Phialophora cinerescens* (map 711) in New Zealand is a Herb. IMI specimen. A published record (e.g., Robinson, 1961, *N.Z. Jl Agric. 18*: 63) is not noted.

I am familiar with some country distributions, especially in the Pacific region, that have been missed. In the latest release of maps this includes *Diaporthe citri* (map 126), which also occurs in Niue, Tonga, and Western Samoa, and *Phytophthora palmivora* (map 725), which also occurs in the Cook Islands and Western Samoa (Dingley *et al.*, 1981, *UNDP/FAO/SPEC Survey of Agricultural Pests and Diseases in the South Pacific* 2). *Leveillula taurica* (map 217), which is given an unconfirmed occurrence for the Solomon Islands (Herb. IMI, specimen not located) has been published (McKenzie & Jackson, 1986, *Strengthening Plant Protection and Root Crops Development in the South Pacific, RAS/83/001, Field Document 11*).

I noted two errors in the map edition numbers. Map 217 is issued as edition 5 for the second time, and map 464 is a duplicate 2nd edition.

The information on the back of the maps is now very spread out, and many maps extend over more than one leaf; some occupy as many as three leaves. In some instances (e.g., map 724) over a page is taken to list the occurrence of a pathogen in the various states of the U.S.A. and, in addition, to replicate a full reference citation 38 times. Historical references on the occurrence of a pathogen are now not necessarily given, but rather a more recent, informative reference is preferred.

I am surprised that Latin binomials are still not denoted by italics. Apart from a footnote on the map, non-bold Roman typeface is used throughout. Some imaginative use of other typefaces might help to separate and clarify some of the information.

For each pathogen the main synonyms and hosts are given, and where available a cross-reference is made to an *IMI Description*. In some cases a short note is added to clarify the particular pathogen name which has been used.

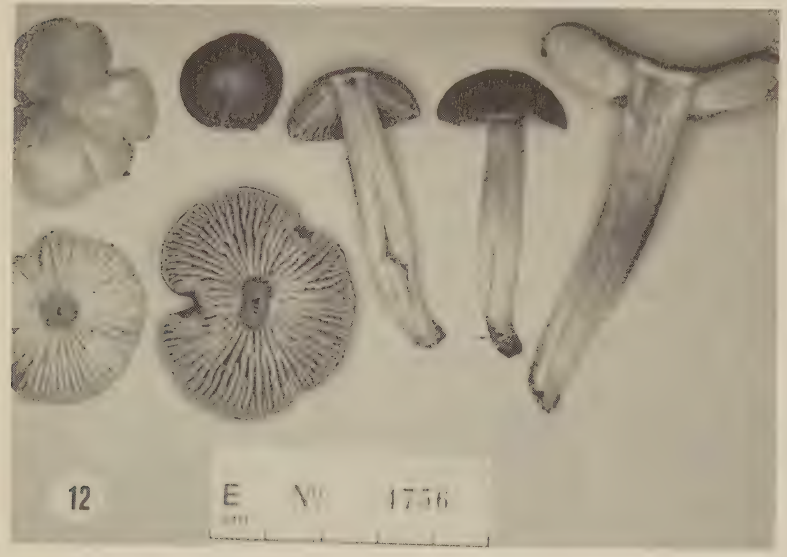
It obviously takes dedication and effort to produce these maps, and over the past 55 years some very valuable information has been extracted from the literature, and from other sources, and supplied to the scientific community. CAB International and IMI are to be congratulated for their perserverence. I look forward to many further new maps and to continued updating of the old, but will also look for improvement in the new format.

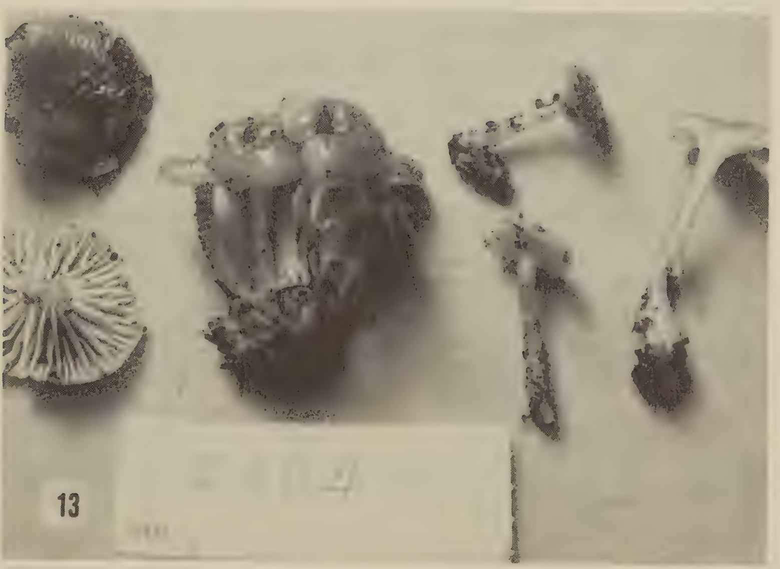
E. McK.

ERRATA

VOLUME SIXTY-THREE

Page 34 [Replacement for figs. 12 & 13, N. L. Bougher and A. M. Young. "Hygrophoraceae of Western Australia"] **Fig. 12.** *Hygrocybe polychroma* basidiomes (holotype). **Fig. 13.** *Hygrocybe viscidibrunnea* basidiomes (CSIRO E604).





ERRATA

VOLUME SIXTY-THREE

Page 345, line 36	for *Trichosporon roberoi*	read *Trichosporon riberoi*

VOLUME SIXTY-FIVE

Page 96, line 10	for *syzgii*	read *sizygii*
98, line 9	" "	" "
Page 354, line 3	for *gaillardi*	read *gaillardii*
Page 371, line 39	for *subrabuptum*	read *subabruptum*
Page 372, line 51	for *leucomallelus*	read *leucomallellus*
Page 459, line 27	for *acsess*	read *access*
Page 460, line 1	for *bicontrol*	read *biocontrol*

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